Electrical World

JUNE 13, 1942

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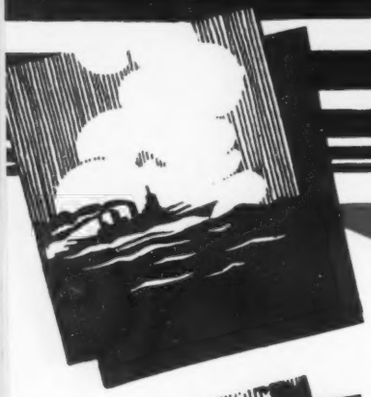

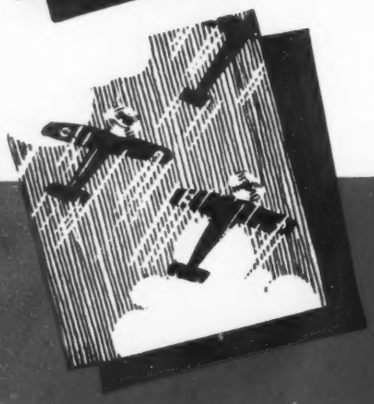

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June 13, 1942 — *Vol. 117, No. 24*

Contents

Eddy-Current Couplings Adjust Oswego Combustion 40
HARRY A. PIASECKI, *Buffalo Niagara Electric Corporation*

Don't Throw Away Anything But Dirt 43
L. RAGLE, *Southern Colorado Power Company*

Practical Blackout Lighting for Factories 44

Improved Lightning Performance of 33-Kv. Wood-Pole Lines 45
C. H. LINDELL, *Cincinnati Gas & Electric Company*

Check Wiring and Transformer Loadings to Maintain Production 49
R. G. HARDY, *General Electric Company*

How to Keep the Blackout Out 52
MYRTLE FAHSBENDER, *Westinghouse Electric & Manufacturing Company*

Sell and Repair Appliances From Trucks House-to-House 54
PAUL K. BERRY, *Kansas City Power & Light Company*

Washington Comment 58

News of the Week 59

Editorials ..... 39 and 56
How 67
Load Building 96
New Equipment 104
News About People 111
Manufacturing and Markets 120
Rural Allotments 125
Sales Opportunities 126
Letters to the Editor 128
Index of Advertisements 134

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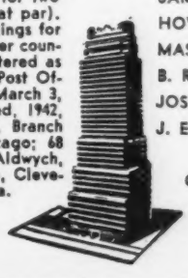
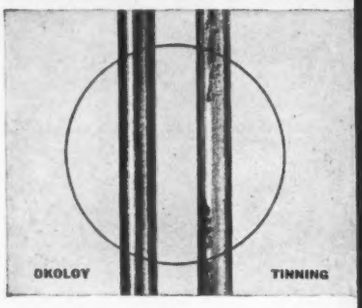


A McGRAW-HILL PUBLICATION

FROM the UTILITIES FOR the UTILITIES

An Electrified America—That Is Today Her Greatest Strength

Between Wars—Pace-Setting Achievements in Transmitting Electrical Power—Pioneered Through Okonite Research



OKOLOY Coating For Conductors Outlasts "Tinning" 2 to 1

Premature failure of expensive cables because of the inadequate conductor protection afforded by "tinning" led Okonite to search for a better coating. Okonite Research Engineers developed Okoloy—an exclusive Okonite alloy coating which has been proved in the field now for thirteen years and outlasts "tinning" at least 2 to 1. The conductors of all Okonite Wires and Cables are protected with this long-lived coating.

To Be Buried and Forgotten—OKOSHEATH Non-Metallic Underground Cables

Bury these rubber-sheathed cables directly in the ground and forget about moisture, soil acids and alkalies, and that costly nuisance — electrolysis. Tough Okosheath, first all-rubber cable for underground use, needs no other protection against mechanical damage. Its simple construction and light weight make it easy and fast to install, easy to splice and connect.

OKOPRENE Protected Wires and Cables Laugh at These Enemy Agents

Sun, oil, chemicals, flame and heat—long the dreaded enemies of rubber insulated cables are practically powerless against an Okoprene sheath — which is bonded by vulcanization to the regular Okonite or Okolite insulation over the conductors. These Okoprene protected cables are more durable and longer lasting than the best braided cables and cost no more.

High Voltage Devils Outwitted by OKOLITE

Corona . . . moisture . . . and heat are some of the problems formerly associated with high voltage circuits that Okolite insulation licked. In addition, Okolite requires no lead sheath which saves weight, cost and eliminates electrolysis. Millions of feet of Okolite are setting new records every day for long life and freedom from trouble on high voltage circuits of nearly every type—some of them with pressures as high as 35,000 volts.

It's Only the Beginning

These examples are typical of the progress through careful research that Okonite has made during the past 20 years in helping the utilities advance the electrical development of this country. That it's only the beginning is proved by the new ideas in the field of synthetics that have come from our all-out effort to help speed victory today. And with the war successfully concluded, we can all take up again the full-time job of making America ever a better place in which to live.

THE OKONITE COMPANY
Executive Offices: Passaic, N. J.
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OKONITE Insulated Wires and Cables

Enterprise

Remarks by people in high position in Washington that the war would be won much sooner than had been expected are all very comforting, but at the same time they are hardly conducive to that all-out spirit that is needed to maintain production. We do not claim to have any superior military knowledge, but is it not axiomatic that no war is won until the last shot is fired? Speculation on when the war will be over is futile. What matters now is how well, how vigorously, all of us wage this war.

That does not mean, however, that we cannot give thought to what we shall do after the war. In fact, we shall be very remiss in our duty, both to ourselves and to those who rely on us for employment, if we do not engage in some careful planning.

We are going to win the war on the battlefield—there can be no question about that. Are we equally sure about winning the peace? Are we equally sure that we are going to progress further and be stronger? We better be sure and we had better be doing something about it, because if we don't somebody else of far less ability and experience will try to do it for us.

There are a great many things to consider in post-war planning, but none perhaps so important as that of personnel. It used to be that a young man was willing to go to work for the electric light company at a very modest wage under routine advancements because he expected security so long as he lived.

Is that very element of security a good thing for the post-war period? Does it possibly bring in its train evils that outweigh any benefits? Does it impose a rigidity on opportunity that is unattractive to men of ambition and ability?

There isn't any doubt but what the post-war era is going to bring new competition—competition that is going to require low costs. There isn't going to be room in this competition for any but streamlined staffs. Many companies will have to get along with fewer employees. This is going to place a great strain upon the old system of employment security.

When rates were determined purely by commission regulation it was possible to base employment incentive on security. It wasn't as enterprising as it might have been, but it was very comfortable. In the post-war period rates are going to be based more and more on competition, whether it be a yardstick or some competitive form of power that will supplant central station service. This competition cannot be met successfully by men who are willing to live in the comfortable atmosphere of security governed by the rules of seniority. Those good old days are gone. The new order will demand flexibility of mind and adaptability to conditions.

Of course, our Number One job today is to win the war, but let's be equally sure of winning the peace—freedom for enterprise, whether it be a business or an employee.

Eddy-Current Couplings Adjust Oswego Combustion

Characteristics of torque-speed response found most advantageous in controlling air-gas flow rates of 900,000-lb.-per-hour steam generators

HARRY A. PIASECKI, Buffalo Niagara Electric Corporation*

OSWEGO steam station of the Central New York Power Corporation forms a part of the Niagara Hudson System and must economically handle rapid load changes when it is assisting in the control of system frequency and must be able to carry continuously loads ranging from 4,000 kw. to 100,000 kw. per unit. During weekends and heavy flow seasons at the hydro plants the steam-driven generators will be carrying minimum loads requiring minimum air and gas flows. Any method of air and gas control must have a very large number of operating points because of the 25 to 1 range in the loading of the generating units.

Designers of the two-unit one-boiler-per-turbine station pondered how best to control the air flow to and the gas flow from the mammoth steam generators. Three schemes were considered to obtain the necessary variation in air and gas flow.

1. By varying the fan speed.
2. Partly by damper throttling and partly by speed change.
3. Wholly by damper throttling.

The following tabulation gives the fan equipment for each boiler, together with the range of fan speeds required if no throttling is used:

Fans	Motor Rating Horse Power	Operating Speed Range R.P.M.
2 Primary air	150	850 to 1,670
2 Secondary air	450	300 to 1,160
2 Induced draft	1,250	100 to 1,160

For varying the fan speeds, the wound-rotor a.c. motors and the field-controlled d.c. motors were considered for direct coupling to the fans; also two types of variable-speed couplings were considered, using constant speed a.c. motors. The variable speed a.c. motors, using either the grid or the liquid rheostat controls, seldom give more than 70 percent speed reduction. Therefore, if this type of drive were used, some damper throttling of the air and the gas would be required.

While the necessary range of speeds could have been obtained with the d.c. field control motors, using the Ward Leonard system, this type of control was discarded because of high first costs. The waste of energy by damper throttling and the relatively few operating points obtainable by using the wound-rotor a.c. motor threw out schemes 2 and 3. While the a.c. motor with the liquid rheostat control provides an infinite number

* Electrical design engineer.

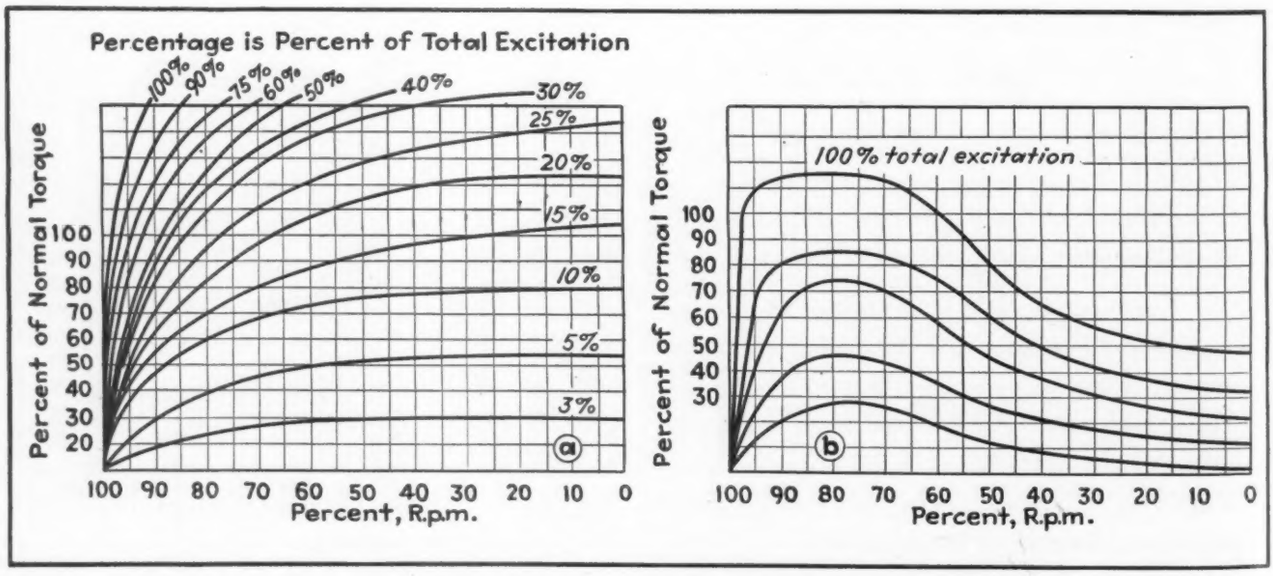


FIG. 1—Torque characteristics of eddy-current coupling show increase as speed of driven member falls off (a) Dynamic coupling torque characteristics. (b) Torque characteristics of other available electric couplings

FIG. 2—Unmounted driving unit of 1,250-hp. eddy-current coupling

Material of outer steel drum has combined properties of (1) suitable permanence to magnetic flux and (2) relatively high electric conductance (to permit ready circulation of eddy currents which control the driving torque).

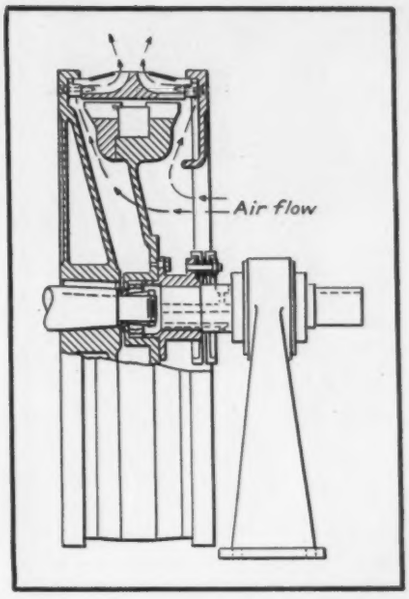


FIG. 3—Dynamatic Corporation adjustable-speed eddy-current coupling has outer drum with milled cooling radiators, air deflector and electromagnet providing opposite north and south poles

of operating speeds within its operating range, this did not give the a.c. motor drive sufficient advantage to warrant its adoption and the liquid rheostat controls were more costly than the grid type of rheostat controls.

Infinite Gradation

The hydraulic as well as the eddy-current type of coupling offered an infinite number of speed steps when installed as a variable-speed device between constant-speed a.c. motors and the fans. Both of these drives require some auxiliary equipment. The fans are installed on the top floor of the boiler house, where the ambient temperature may be as high as 135 deg. F. in the summer time.

Characteristics of the eddy-current type of coupling, which made it so suitable for our fan drives, are as follows:

1. It provides a linear speed characteristic whereby the fan speed is directly proportional to the control air pressures received from the combustion control.
2. It permits the use of the simplest type of motor drive (squirrel-cage motor).
3. The coupling is air-cooled and requires no separate means of cooling.
4. The heat is generated in the constant-speed outside member and is dissipated by the fan action of the coupling itself.
5. The response of the coupling is practically instantaneous.
6. Speed reductions up to 90 percent are obtainable by simple means.
7. An infinite number of speed steps are available.
8. No large quantities of oil are required in the high ambient temperature existing on the fan floor.
9. The excitation required by the coupling is less than one-half of 1 percent of the motor rating.

For any given excitation, the torque of the eddy-current coupling (Fig. 1, curve A) increases as the speed of the driven members fall off, a characteristic not required for fan drives, but very valuable for drives where the torque requirement of the load does not fall off with speed reduction.

The driving unit of this type of coupling has a simple outer steel drum construction (Fig. 2) which provides high efficiency with minimum of rotary mass. Suitable air passages and radiators provide ample cooling to the drum, which spins at constant speed. The inner rotor, the driven unit, is shaped like a spur gear whose teeth have been suitably proportioned to produce high tractive force. The middle portion of the face of the gear-like member is cut away to provide a recess for the magnet coil with class B glass-covered wire insulation. This construction provides reiterative north poles on one side and south poles on the other side of the powerful and efficient electromagnet. The design is illus-

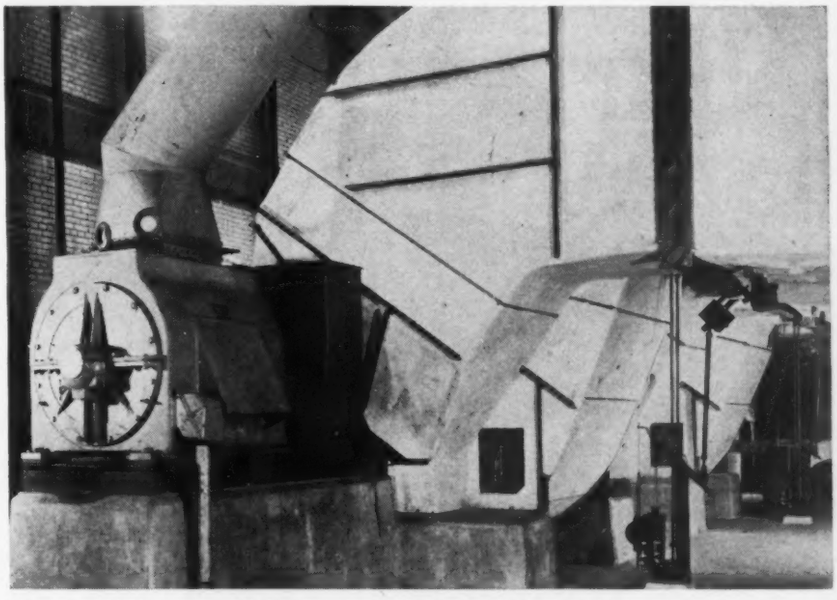


FIG. 4—1,250-hp. squirrel-cage motor drives induced-draft fan by means of eddy-current adjustable-speed coupling

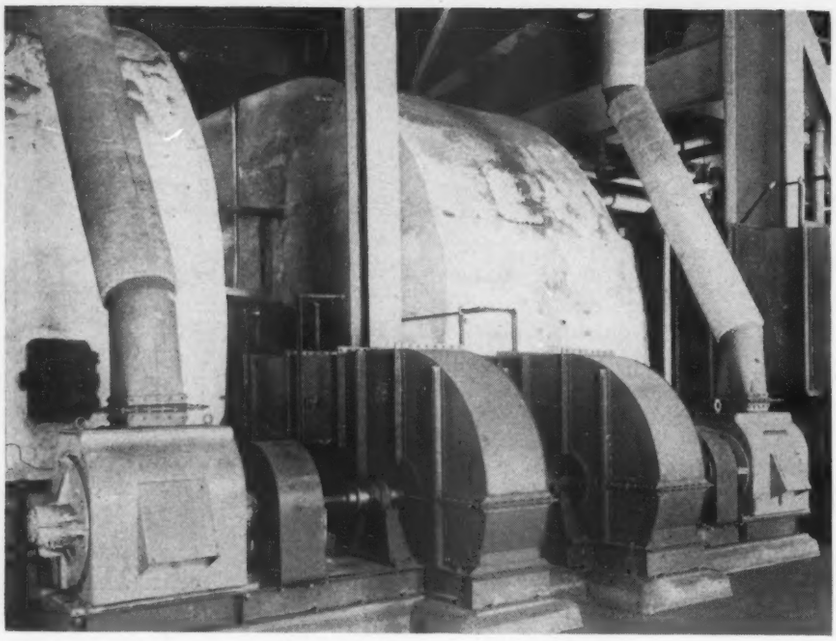


FIG. 5—Two 150-hp. primary air fans for No. 1, 900,000-lb.-per-hour steam generator

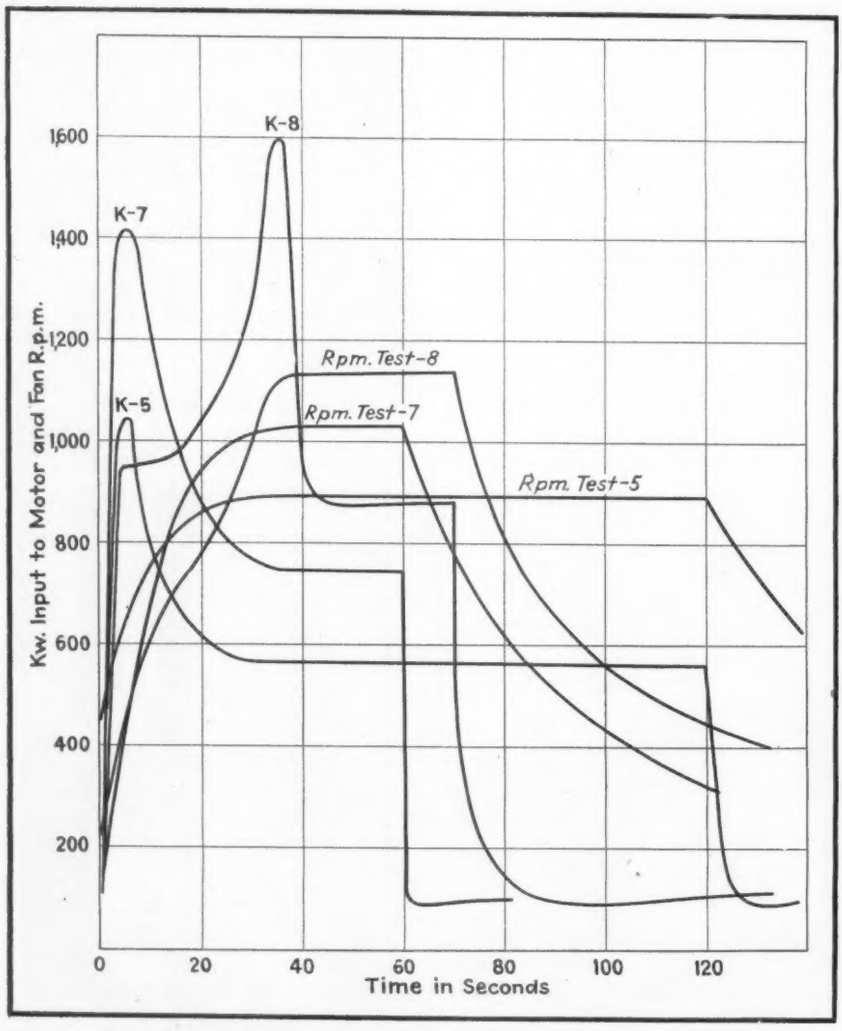


FIG. 6—Combined response of coupling excitation and fan speed of 1,250-hp. unit. Fan speed increased and then decreased by suddenly changing generator excitation to predetermined value. In test run No. 8 the power required to accelerate the fan exceeded available synchronous power of the motor

trated in Fig. 3, where the driving member is mounted on the extension of the motor shaft. Similar units for Huntley station will be provided with two bearings. The driving member is mechanically coupled to the motor and the driven member is mechanically coupled to the fan. The 1,250-hp. induced-draft fan units are shown in Fig. 4 and the 150-hp. primary air drives are shown in Fig. 5.

Load Tests

Before the fans were connected to the boiler response and load tests (Fig. 6) were made on one of the 1,250-hp. induced-draft fan units. The test revealed that the induced-draft fan could be accelerated from about 200 r.p.m. to 1,140 r.p.m. within 40 seconds and that the torque of the coupling was greater than that of the motor driving it. At the time that tests 5, 7 and 8 were started the 1,250-hp. squirrel-cage type induction motor was idling at synchronous speed. A different excitation was applied practically instantaneously to the coupling for each test to determine the rate of change of fan speed (rate of coupling response) and the corresponding rate of change in motor input. The speed curves (Fig. 6) were plotted from readings taken at five-second intervals of fan speeds and motor kilowatt input values.

Note that for tests 5 and 7 the maximum input to the motor was reached within five seconds after the excitation was applied. For the new unit at the Huntley station the couplings will be provided with torque-control devices which will permit acceleration of the fans without taxing the motor beyond its pull-out torque. Separate motor-generators furnish the current for the 400-hp. and the 1,250-hp. couplings, while copper oxide rectifiers furnish the current for the 150-hp. couplings.

Ten of the twelve fans have suitable rheostats for controlling the coupling current to obtain straight line relationship of speed versus transmitted control air pressure from the automatic combustion controls; two of the 1,250-hp. fans are equipped with speed governors having similar straight line performance.

Thus far the couplings have given satisfactory performance. Boiler and turbine unit No. 1 went into service in September, 1940, and unit No. 2 in June, 1941.

Don't Throw Away Anything But Dirt

Metals, meters, transformers, paper, rubber, lead salvaged and reused, restored or sold as junk in conformity with WPB reclamation drive

L. RAGLE,* Southern Colorado Power Company, Pueblo

FOR the duration of the war our motto is "Don't Throw Away Anything But Dirt." All departments are participating in a comprehensive program which is directed principally at recovery of the following materials and equipments:

1. Scrap copper.
2. Scrap aluminum.
3. Scrap brass.
4. Scrap lead.
5. Bronze borings.
6. Babbitt scrapings — tin, antimony, copper.
7. Chrome-nickel resistance wire.
8. Scrap cast iron—worn brake shoes, burnt stoker castings.
9. Scrap steel.
10. Scrap meters.
11. Scrap transformers.
12. Paper and cardboard.
13. Scrap rubber.
14. Scrap batteries.
15. Brass sockets on burned out lamps.

A letter to all these departments and posters on all bulletin boards emphasized the national urgency. It places responsibility on each individual foreman and employee. The program is bringing results. Scrap is rolling into the warehouses.

Comprehensive Program

Electric system materials and equipments which are being conserved by the program cover a wide range, as indicated by the variety of the following items:

(a) Short lengths of weatherproof and other copper wires are soldered or sleeved and returned to stock for future use.

(b) Carriage and machine bolts are salvaged and rethreaded into shorter lengths when necessary. Braces are straightened and returned to stock.

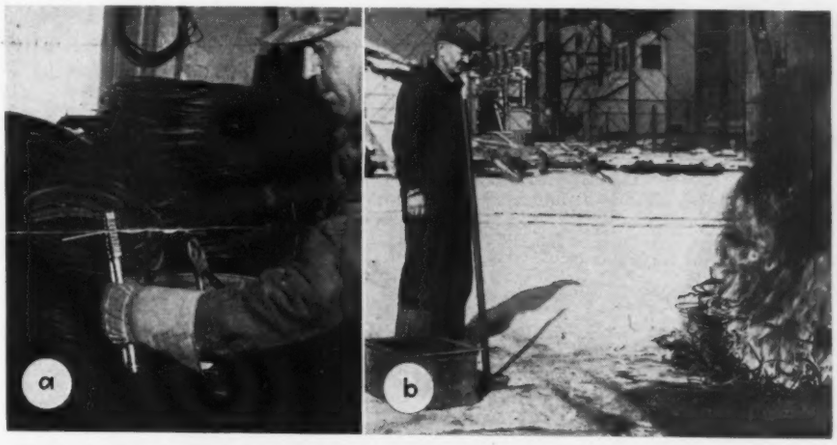
(c) Poles are cut off and the butts creosoted.

(d) Electric range coils are repaired, whenever possible, by the use of a repair sleeve, rather than installing a new coil.

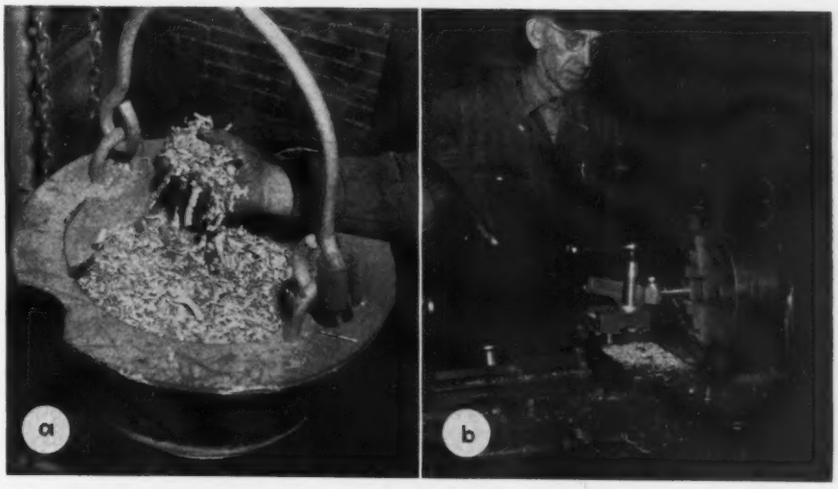
(e) Use of Sil-foss and Ezy-Flo solders to repair customer's appliances, instead of replacing with new parts.

(f) Instead of replacing new meter dial faces we pin any curled spots with brass escutcheon pins.

(g) Clean and repair time clocks



GOOD WIRE respliced (a), old has insulation removed (b) and the scrap is tamped into junk briquets by means of a steel box that serves as a mold



SCRAPINGS and turnings saved. (a) All babbitt scrapings from bearings are remelted for use in making up another babbitt bearing. (b) Machinists carefully save every thread and shaving from a machined piece of bearing bronze

*Purchasing agent.

BURNED-OUT electric range coils are repaired with special sleeves; this averts use of new coils and the consumption of nichrome wire

and demand meters instead of replacing with new sealed units.

(h) Instead of replacing worn-out contacts with new contacts on starting switches and controllers a new system has been worked out of welding a reinforcement plate of pure silver over the old contact. This is expensive, but the contacts will then last indefinitely, and the copper saved can be diverted to war purposes.

Welding Is Helpful

Various types of welding have proved helpful in repairing old parts rather than purchasing new parts. An experienced, imaginative and clever welder can repair almost anything. Here are a few examples:

(a) To repair worn sleeves on 30-in. circulating pump for the 7,500-kw. power plant, our welder built up with bronze the worn packing gland sleeves.

(b) Worn points on large impeller were built up with bronze weld. New impeller would have cost $800 and the old one thrown into the scrap bins. Building up the old impeller released 500 lb. of bronze for war needs.

(c) Babbitt linings on turbine bearings refaced with babbitt, rather than melting out entire bearing.

(d) Turned out steel pulley 4 ft. in diameter in own shop, using machinists and welders during odd moments. This releases overworked factories working on war contracts of the responsibility of furnishing parts for this company.

In the rehabilitation of obsolescent equipment each department handles its own materials. No special department has been set up for the purpose. However, in some cases parts are sent to local welders, painters, armature workers, etc.

Meters are restored by installation of new jewels, pivots, coils, etc. New coils are put into damaged transformers.

One piece of special equipment provided for salvage operations is a steel box which facilitates tamping scrap copper into briquets for more compact handling as junk.

Reclaimed material is stocked alongside new material without discrimination. An exception is weatherproof wire in which the covering is in deteriorated condition; it is placed in stock at a depreciated price. A list or catalog of reclaimed supplies is prepared to keep employees informed of their availability.

• • •

Practical Blackout Lighting For Factories

WARD HARRISON, General Electric Co., Nela Park Engineering Dept.

SEVERAL METHODS have been suggested to avoid the installation of a separate blackout lighting system for industrial building interiors and in this way reduce the cost, labor and critical materials involved in such blackout installations. Following are some of these methods:

1. Filament Installations

Where lamps are housed in industrial reflectors which come down well over the lamp, the voltage may be dropped to a point where the light output per unit is down to a maximum of 3 lumens per unit, which is the maximum light output permitted by the War Department Specification for Blackout of Buildings.

It will be found that with lamps of 150 to 300 watts, getting them down to 3 lumens or less involves cutting the voltage on the lamps to something like ⅓ of the normal value. This may be accomplished by:

(a) Rebuilding the panelboard so that five lighting circuits can be quickly placed in series with each other (in most cases this is not easily accomplished); or

(b) Providing a 20 or 25-volt transformer and a means of throwing the panelboard over to this supply; or

(c) Opening the main switch on the panelboard and shunting a resistance across it. Cast-iron resistors are probably most suitable for this purpose. (It must be remembered that 20 percent voltage puts about 40 percent current through the lamps and the resistance must be capable of disposing of a large amount of energy.)

2. Fluorescent Installations

Here the characteristics of electric discharge lamps make a very simple solution practical; 15-watt inside-frosted lamps provided with suitable reflectors can be permanently attached to the wiring system and kept burning all the time the circuits are on. A line voltage of something like one-half of normal is necessary to bring the 15-watt units down to blackout levels and this voltage is not sufficient to keep the fluorescent units lighted. During blackouts, therefore, the load on the system will not have to be very much more than the total of the 15-watt lamps themselves. The use of a variac at the panelboard is probably the simplest way of controlling this small load. (*Caution*: The above applies to those fluorescent installations that employ the glow type of starters. Thermals will draw relatively heavy current at ½ line voltage.)

3. Combination Filament-Mercury Installations

The voltage of the entire system may be dropped in the same manner as indicated in (1). The incandescent units will give the necessary blackout lighting, while the mercury lamps will not operate on the lowered voltage; this reduces the amount of power to be dissipated in resistance.

Improved Lightning Performance of 33-Kv. Wood-Pole Lines

Literature of art digested to provide step-by-step basis for conversion of ridge-pin construction to wishbone pattern affording better shielding and coupling

C. H. LINDELL, Electrical Engineer, Cincinnati Gas & Electric Company*

DESIGN of wood-pole transmission lines we believe has not been so adequately solved as for steel tower lines. Other than balancing the structures electrically from an impulse value standpoint, the proper coordination of ground resistances, impulse values and correct location of ground wires has not been definitely ascertained. It appears that the location of the ground wire on a wood-pole line due to the necessity of smaller spacings is more critical than that of the tower line.

Design curves presented herewith register an attempt to determine the correct ground wire location with respect to the conductors that it protects to insure the best possible operation. A method has also been developed for introducing a ground wire properly to divert lightning strokes on the older constructions not equipped with ground wires and without increasing the height of the poles.

Conclusions

Probable outage record (outages per 100 miles per year) of the various 33-kv. constructions as taken from the design curves may be summarized as shown in the table below.

This would indicate that the special construction would give a better operating record and still require less bayonet height than the standard construction.

Design Curves

Present 33,000-volt construction employs a pole averaging 40 ft. in height, using a 66-in. bayonet to support the ground wire (Fig. 1). Wood braces are used to increase the impulse strength of the structure.

The potential difference between the ground wire and the conductor at any point is

$$P.D. = (1 - K)\ V_p$$

When $P.D.$ = Potential difference
K = Coupling factor
V_p = Voltage in ground wire at point in question

The coupling factor is equal to

$$K = \frac{\log a/b}{\log 2h/r}$$

When K = Coupling factor
r = Effective radius
h = Height above true ground plane
a = Separation between the conductor and ground wire image
b = Separation between ground wire and conductor

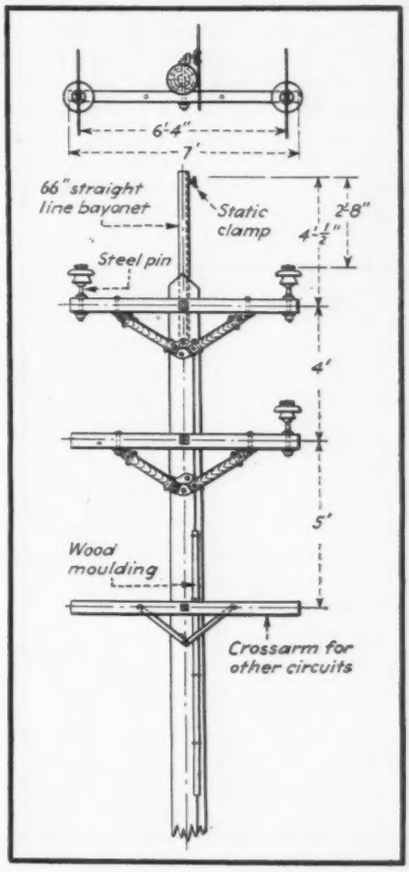


FIG. 1—Prevailing standard 33-kv. wood-pole line construction of Cincinnati utility uses 66-in. bayonet

Ground Resistance	5 ohms	10 ohms	20 ohms	30 ohms
Present 33-Kv. Construction				
Ground wire 2 ft. 8 in. above top conductor (Fig. 1)	6.65	7.75	10.1	12.8
Minimum Outage Record				
Standard construction (ground wire approximately 4 ft. 5 in. above top conductor)	4.85	6.1	8.25	11.3
Minimum Outage Record				
Special construction (ground wire approximately 3 ft. 6 in. above top conductor)	4.40	5.65	7.70	10.6

For ground resistances of 5 and 10 ohms a depth of ground plane of 30 ft. was used and for ground resistance of 10 and 20 ohms we used depth of ground plane of 60 ft.

Effective radius of a conductor carrying a high voltage is assumed greater than its actual physical radius due to corona effects. This effective

*Excerpts from E.E.I. paper which was awarded the first of three James H. McGraw prizes for "most meritorious on any engineering or technical subject relating to the electric light and power industry."

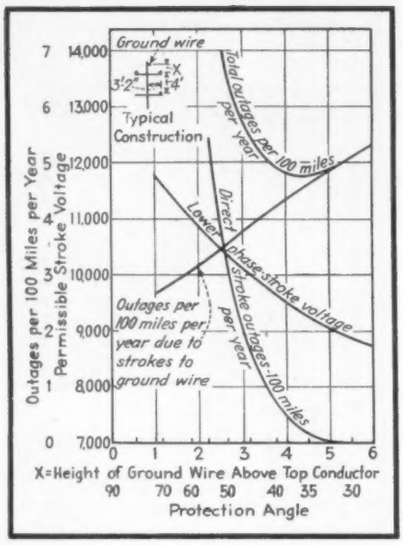


FIG. 2—Permissible voltage at ground wire of standard construction for various elevations of ground wire, 5-ohm ground, 250-ft. spans on 40-ft. poles. Isoceraunic level of 50. Resulting outages per 100 miles per year. Based on 100 percent shielding against direct stroke to any conductor. Total outages more than doubled if ground resistance is 30 ohms

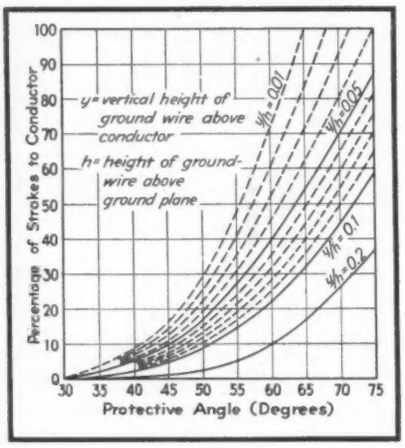


FIG. 3—Percentage of direct strokes for various protective angles based on ratio of cloud height to ground wire height of 5/1 to cover effect of wind and recognition of effective height of ground wire above ground

radius is a function of the voltage and is expressed by the equation.

$$E = 175.3\ a \log \frac{2h}{a} \text{ kilovolts}$$

Where a = The effective radius of the space charge

h = The height above the ground plane

With our standard configuration as a basis, maintaining a 4-ft. spacing between the top arm and the bottom arm, the permissible voltage to the ground wire before flashover of the lower phase occurs was calculated (Fig. 2) for variations of ground wire of K plus 4 ft. above the bottom phase. Similar curves were established for 10-, 20- and 30-ohm ground resistances.

Curves were drawn (Fig. 3) which indicate the percentage of strokes that would strike the conductor at various protective angles.

Characteristics Assembled

Characteristics of our 33-kv. construction are shown in Table I. To properly apply the percentage of the strokes to conductor, we investigated our outage records for 33-kv. lines which are built on ridge-pin construction having no ground wire, thus affording no protection to direct stroke, and found that the average outages per 100 miles per year for eleven operating years of 82 miles of construction was 15.8. We therefore assume that this represents the fair probability of direct strokes to lines of the height and character of the line under question for our territory. By applying the percentages of strokes to the conductors obtained from Fig. 3 to the figure of 15.8 strokes per 100 miles per year, we are able to compute the total outages per 100 miles per year due to direct stroke to conductor for various protective angles on lines in the vicinity of Cincinnati.

Probability of direct stroke outages for various protective angles (Fig. 4) assumes a definite cut-off of 30 deg. was used for the y/h curves. This injects a slight safety factor to provide for the antics of natural lightning.

These direct stroke outage curves were then plotted on Fig. 2 and the companion charts, using the 30-ft. ground plane curve for the 5- and 10-ohm design curve and the 60-ft. ground plane curve for the 20- and 30-ohm curves. These direct stroke curves then indicate the direct stroke outages per 100 miles per year, which are caused only by strokes to the conductor and come as a result of improper shielding. We can now add the outages per 100 miles per year due to strokes to the ground wire and the outages per 100 miles per year due to improper shielding and obtain a curve which represents the probable total outages per 100 miles per year for various heights of ground wire above conductor.

Total Outage

Total outage curve of Fig. 2 coincides with the back-flash outage curves for protective angles less than 30 deg., but at values greater than 30 deg. the direct stroke outages influence its shape. The outage curve decreases to a point at about 36 deg. for all curves, and from this point as the ground wire is lowered the direct stroke outages become more prevalent and the curve begins to rise sharply. It is noted that this rate of increase decreases as ground resistances increase, and at 30 ohms it appears possible to approach a protective angle of approximately 43 deg. without considerable increase in outages per 100 miles per year.

In the vicinity of Cincinnati a lime stone stratum as a rule gives fairly low ground resistances. We therefore feel it possible to design pole lines with ground resistances as low as 5 ohms. It is therefore our intention to at least design our structures for 5 ohms resistance, and if the

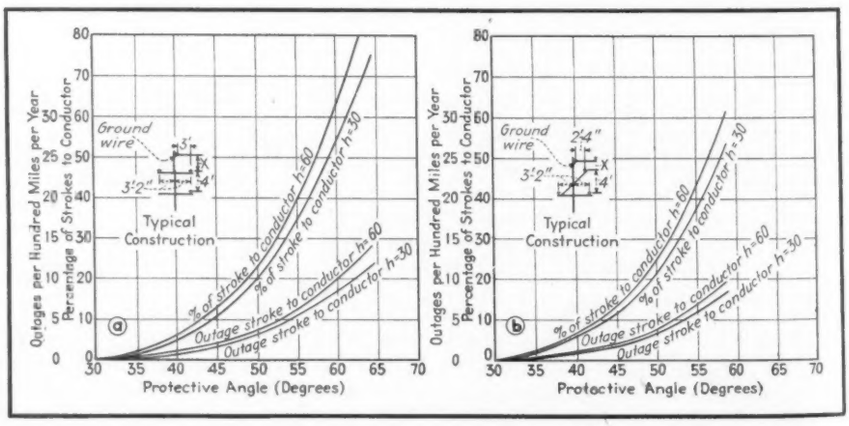


FIG. 4—Probability of direct strokes for various protective angles and ground plane locations. (a) For standard bayonet construction. (b) For special ridge-pin, wishbone-type configuration (Fig. 6)

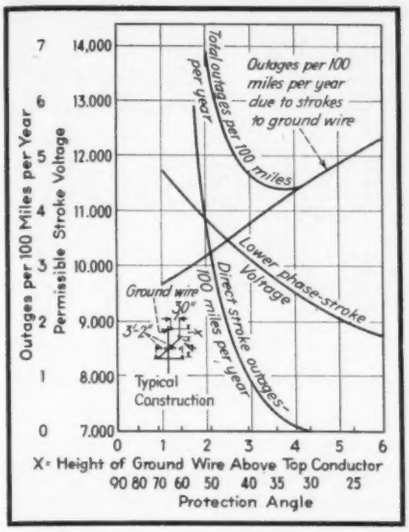

Outages per 100 Miles per Year
Permissible Stroke Voltage
Total outages per 100 miles per year
Outages per 100 miles per year due to strokes to ground wire
Lower phase-stroke Voltage
Direct stroke outages-100 miles per year
Ground wire
30"
3'-2"
Typical Construction
X= Height of Ground Wire Above Top Conductor
Protection Angle
90 80 70 60 50 40 35 30 25

FIG. 5—Permissible ground wire voltages and outage expectancies for special wishbone-type construction otherwise similar to Fig. 2. Total outages likewise are more than doubled if ground resistance is 30 ohms instead of 5 ohms

line is not initially installed with sufficient rods to reach this level, we can improve our grounds periodically to approach this minimum. Taking into account mechanical features, present drilling in poles, etc., we have selected as the best operating height in our particular case a height of ground wire above top conductor of about 4 ft. This distance is now only 2 ft. 8 in., which gives a poor protection angle in addition to giving poor midspan clearance.

Special Rural Construction

The voltage that results in the top conductor and that which results in the lower conductor during a stroke to the ground wire varies with the respective coupling factors. This hypothesis would enable use of a lower impulse value for the combined wood and insulator on the top phase than would be necessary for the lower combination.

This makes it possible to shift the top phase in toward the pole, thus decreasing the protective angle and permitting a reduction in the required height of ground wire, which in turn would increase the coupling factor. The design curves shown on Fig. 5 are based on this principle with the top insulator located 30 in. from the center of the pole.

Actually it is possible, by taking advantage of the ratio of the coupling factor, further to reduce this distance and still maintain a balanced electrical design, but we are dubious, without actual operating experience, to what extent we can rely on the coupling factor to reduce potential differences between ground wire and conductor.

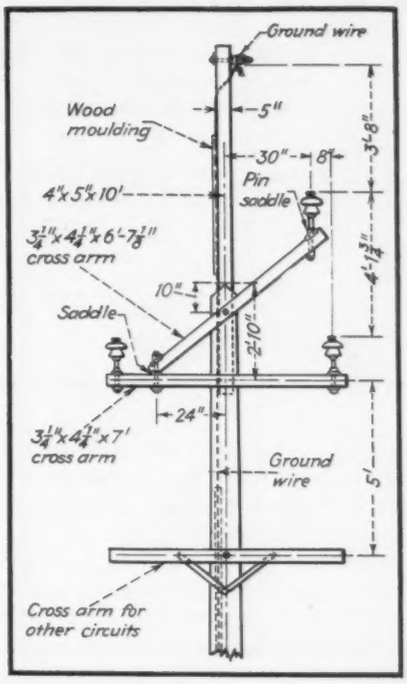


FIG. 6—Prior ridge-pin construction readily capable of modification to bettered shielding. The 10-ft. 4x5-in. timber extends the ground wire to an elevation of 3 ft. 8 inches above the top conductor

Shifting of the top insulator lends

Table I—Direct Stroke Outage Curve for 33-kv. Standard Construction—Isoceraunic Level = 50

y = vertical height of ground wire above conductor. h = height of ground wire above ground plane.

Ground Plane = 30					*Ground Plane = 60*				
x = Height of Ground Wire above Conductor	$\frac{y}{h}$	Protection Angle	Percent of Strokes to Conductor	Total Outage per 100 Miles per Year Based on 15.8 Strokes	x = Height of Ground Wire above Conductor	$\frac{y}{h}$	Protection Angle	Percent of Strokes to Conductor	Total Outage per 100 Miles per Year Based on 15.8 Strokes
1	0.015	72° 30′	——	——	1	0.01	72° 30′	——	——
1½	0.0224	64° 40′	75.5	11.92	1½	0.0154	64° 40′	89.0	14.0
2	0.03	57° 45′	44.5	7.04	2	0.0206	57° 45′	51.0	8.06
2½	0.0373	51° 40′	23.5	3.72	2½	0.0258	51° 40′	27.0	4.27
3	0.04	46° 30′	13.0	2.05	3	0.0309	46° 30′	15.0	2.37
3½	0.052	42° 10′	6.8	1.08	3½	0.0361	42° 10′	8.2	1.30
4	0.06	38° 40′	3.5	0.55	4	0.0412	38° 40′	4.5	0.71
5	0.075	32° 40′	0.4	0.06	5	0.0512	32° 40′	0.8	0.12

Table II—Direct Stroke Outage Curve for 33-Kv. Special Construction (Top Ins. 30 In. Out)—Isoceraunic Level = 50

Ground Plane = 30					*Ground Plane = 60*				
x = Height of Ground Wire above Conductor	$\frac{y}{h}$	Protection Angle	Percent of Strokes to Conductor	Total Outage per 100 Miles per Year Based on 15.8 Strokes	x = Height of Ground Wire above Conductor	$\frac{y}{h}$	Protection Angle	Percent of Strokes to Conductor	Total Outage per 100 Miles per Year Based on 15.8 Strokes
1	0.015	68°	——	——	1	0.01	68°	——	——
1½	0.0224	59°	54	8.54	1½	0.0154	59°	61.5	9.72
2	0.03	51° 30′	25.5	4.04	2	0.0206	51° 30′	29.0	4.58
2½	0.0373	45°	11.5	1.82	2½	0.0258	45°	13.0	2.05
3	0.04	40°	5.8	0.917	3	0.0309	40°	6.5	1.03
3½	0.052	35° 30′	2.25	0.355	3½	0.0361	35° 30′	2.8	0.44
4	0.06	32°	0.50	0.078	4	0.0412	32°	0.75	0.12
4½	0.067	29°	——	——	5	0.0512	26° 30′	——	——
5	0.075	26° 30′	——	——					
5½	0.682	24° 30′	——	——					
6	0.090	22° 30′	——	——					

Table III—Outage per 100 Miles per Year—Record of 33,000-Volt Lines With Ground Wire

(Configuration as per Fig. 1)

Line	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Average
551	8.58	17.17	30.70	23.0	31.32	0	35.6	7.26	21.8	0	0	14.2
651	24.0	0	23.0	0	17.6	0	17.6	5.70	5.70	0	0	9.75
851	23.2	23.2	9.4	4.68	4.68	4.68	9.40	4.68	23.5	9.40	0	11.10
852	14.18	14.18	0	0	0	0	0	0	28.36	0	0	5.15
853	17.65	8.82	8.82	8.82	8.82	17.65	13.25	0	13.25	0	0	8.72
2353	.....	.....	0	10.50	10.50	0	10.50	0	0	0	9.45	4.35
3151	2.66	5.30	8.0	2.75	2.75	5.58	5.58	5.58	18.65	7.95	7.95	6.72
Average	12.50	15.0	10.9	8.64	7.02	10.2	7.85	4.69	13.2	4.65	3.87	

Average number of outages per 100 miles per year for the eleven-year period = 8.88

itself to a construction similar to the old wishbone type construction which seems economical and sturdy. This construction (Fig. 6) can presumably be used in rural territory as an economical construction without a ground wire.

This modified 33-kv. construction permits rebuilding of existing ridge-pin construction without removing the lower arm and without any field drilling. We are now rebuilding approximately 13 miles of this ridge-pin construction in the vicinity of Cincinnati.

Actual 33-Kv. Line Operation

To determine how close our theoretical calculations and design curves compare with actual operating records of our standard 33,000-volt lines, we compiled the figures indicated in Table III.

The average number of outages per 100 miles per year for the eleven-year period is 8.88. Average ground resistance of the 33-kv. construction is approximately 10 ohms. The 10-ohm design curves give 7.75 outages per 100 miles per year; this compares very favorably with the actual average outage figure of 8.88. The 33-kv. lines were all built with steel angle braces. We have, however, gradually replaced these braces with wood braces. Approximately 14.9 percent of the record represents wood braces.

Use of wood braces instead of steel braces reduces the permissible stroke voltage to the ground wire before flashover occurs by approximately 41 percent. This results in a reduction of probable outages of 61.4 percent.

The actual outage record is lower than the theoretical outage record corrected to compensate for the use of a certain percentage of steel braces. We believe an explanation for the lower outage record (actual) is due to the shielding effects of hills, buildings, chimneys, trees, etc., in the vicinity of Cincinnati which would affect portions of these lines. Our calculations are based on fairly flat topography with no shielding effects.

Essential Mileage Saves Tires, Gas

METHODS or procedures adopted or modified for the purpose of effecting economies in the use of automotive equipment since December 7 are reducing Pacific Gas & Electric Co.'s passenger car mileage reduction of 25 to 40 percent. A variety of steps has been taken to meet current war conditions.

To meet the conditions resulting from loss or anticipated loss of personnel, maintenance organizations have been reviewed and plans developed for the centralization of certain classes of maintenance work which have theretofore been conducted on a decentralized basis.

For the specific purpose of economizing in the use of tires, a number of measures have been introduced, including removing from service of non-essential vehicles, elimination of non-essential mileage in the case of essential vehicles continued in service, increased use of pooled vehicles in place of assigned vehicles, substitution of public transportation facilities and bicycles for automotive transportation wherever practicable, and the elimination of non-essential activities on the part of the commercial and operating departments. Preliminary reports indicate that these changes in operating methods will effect a reduction in passenger-car mileage of between 25 and 40 percent.

Further savings in both rubber tires and gasoline, as well as in repair costs, will result from instructions to drivers directing operation at reduced speeds and moderated acceleration and deceleration rates. In some instances governed speeds have been lowered so that prevailing maximum for light vehicles is 45 miles per hour.

In order to minimize abnormal tire wear, frequency of inspection has been increased, and the service men as well as mechanics instructed in methods of recognizing various types of abnormal wear so that faulty conditions can be promptly corrected. All worn tires have been carefully inspected for causes of abnormal wear or failure and for possible salvage by repair.

Overloading

Strict attention is being paid to the question of overloading of vehicles on account of its effect on both the wearing out of tires and maintenance of the vehicles themselves. Crankcase lubricating oil is now receiving particular attention. For the past year, vehicles have been operating with the compound type of oil under close observation. At the present time a study is being made to determine the maximum effective life of that type of oil as well as in the possibilities of its being reclaimed.

Particular attention is also being paid to possibilities of salvaging worn or broken parts which in normal times would be replaced. The processes of hard-chrome plating, metal spray, and welding—both electric and oxyacetylene are being used. Parts salvaged from vehicles taken out of service are being utilized to maintain other vehicles of like models.

Check Wiring and Transformer Loadings to Maintain Production

Growth of load on industrial plant electrical facilities may get out of hand unless close watch is kept on equipment temperatures and voltage regulation and remedial measures taken

R. G. HARDY, General Electric Company

WAR PRODUCTION is placing loads on industrial plant electric distribution systems which in many cases have never been experienced before. Additional load demands are being reached. Lengthened shifts and more working hours are increasing the load factors. What is the effect on transformers in the plant? On plant wiring?

Transformers and associated equipment do not have the cooling periods between peak loads that they formerly did. Bottlenecks in plant wiring show up in most cases as heating limits; in some as poor regulation or undervoltage problems, including flicker.

This means that the plant electrical superintendent and electrical engineer have a bigger role in keeping production rolling than they have ever had before.

Overload Creeps Up

One of the most important jobs in preventing transformer failure is to be constantly alert for signs of overloading. Today loads have a way of creeping up gradually with the addition of a motor here and an extra bay of high-level lighting somewhere else, before the magnitude of the total is fully appreciated. If power is purchased and the local utility company owns the main incoming bank of transformers, it is usual to expect the utility to maintain the bank. Nevertheless, it is to the interest of the plant engineer to keep check of the loading on the bank.

The surest check on the loading of transformers is by the proper use of instruments such as ammeters, voltmeters and temperature-indicating, demand-indicating equipment.

HOOK-ON AMMETER on extension pole being used to measure transformer secondary current

Transformers within the industrial plant should be checked for proper condition of oil and oil level. Samples should be tested periodically to guard against sludging and excess moisture. Transformers which are being worked to the limit of their rating may show oil sludging, which is particularly vicious because the sludge deposits on the coils and obstructs proper cooling of the coils.

Proper ventilation of self-cooled transformers is highly important. To prevent overheating, ventilation must be adequate to carry away the heat resulting from transformer losses. When transformers are originally installed this factor is always considered, but subsequent changes in plant layout may obstruct the flow of air past the cooling tubes or radiating surfaces.

Forced Cooling

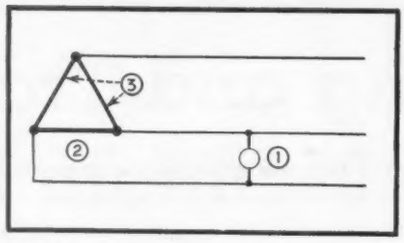
Extra capacity can sometimes be gained by adding fans to self-cooled transformers to agitate the layer of air immediately surrounding the radiating surfaces, thereby increasing the heat radiation. By this expedient the continuous rating of the transformers in smaller banks may be increased as much as 25 percent, and on larger capacity banks the increase may be as great as 33⅓ percent continuous operation. The engineer should first check with the manufacturer of the transformers to determine if this can be done and what increased rating can be secured.

The nameplate rating of a transformer is its continuous rating. That is, it will carry the stated kva. continuously without exceeding specified temperature rise over and above a stated ambient temperature. It is recognized, however, that a transformer (particularly of the liquid-filled, self-cooled type) can carry certain overloads for short periods of time. Naturally, the greater the overload the shorter the period of time it can be carried. Also, this overload condition must occur following stated conditions of normal continuous operation.

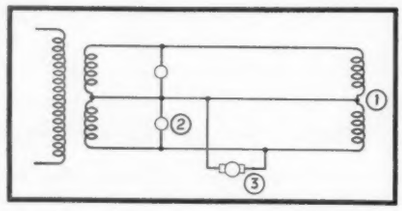
The American Standards Association has established curves which show permissible short-time overloading of transformers. Permissible

short-time loadings following no load are as follows: Twice normal for 20 minutes; one and one-half times normal for one hour, and one and one-quarter times normal for three hours. Recognition of these permissible short-time overloads may be very valuable in plant operation in these times of heavy production. An emergency condition may arise wherein the use of short-time overload capacity may mean the difference between slowing down or keeping up production.

"Trading on" this short-time overload capacity of the transformers must be done with caution, however. Repeated short-time overloading may have a deleterious effect and certainly will tend to show up any weak spots in the transformer. Sludging of the oil may be accelerated. However, recurrent overloading within proper limits is recognized by the A.S.A.



CURRENT of single phase load (1) divides 0.8 on large transformer (2) and 0.2 on two others (3) of half the size in closed delta connection



BALANCING auto-transformer (1) connected at remote end of 3-wire feeder alleviates flicker on lights (2) caused by intermittent operation of motors (3)

Closed and Open Delta

Special transformer connections within the plant offer extra capacity possibilities, but must be made properly. A closed delta secondary may be used to supply a load consisting of a predominant single-phase load and incidental three-phase load of much lower value. This closed delta may consist of three single-phase transformers, two of which are relatively small, while the third, which is on the phase carrying the heavy single-phase load, is larger. It must be remembered that the current supplying the heavy single-phase load will not distribute uniformly within the three legs of the closed delta. For example, if the larger transformer is twice the size of the two smaller ones, 80 percent of the single-phase load current will flow through the larger transformer and the remaining 20 percent load current will flow through the two other single-phase units in series. It is necessary, therefore, that these two lightly loaded phases be supplied by single-phase transformers with sufficient capacity to carry not only the three-phase load but also their share of the single-phase load.

This problem of proper transformer capacities in a bank supplying heavy single-phase and lighter three-phase loads will be more easily met if the transformer bank is connected in open delta. Then, all the load current to the heavy single-phase load will be supplied solely by the transformer connected across that phase.

In either of the above schemes, but particularly with the open-delta connection, there will be an unbalance of voltage regulation between the three phases, and this should be considered when using such connections.

Wiring Limitations

Let us now consider limitations in the plant wiring and what can be accomplished by changes in use of transformers to meet these wiring limitations. First thing to do is check on the distribution of the loads throughout the plant. Some of the transformers and feeders may be overloaded; others may be underloaded. If the layout in the plant is such that a few simple but judicious transfers of loads can be made, underloaded feeders can take up some of the burden.

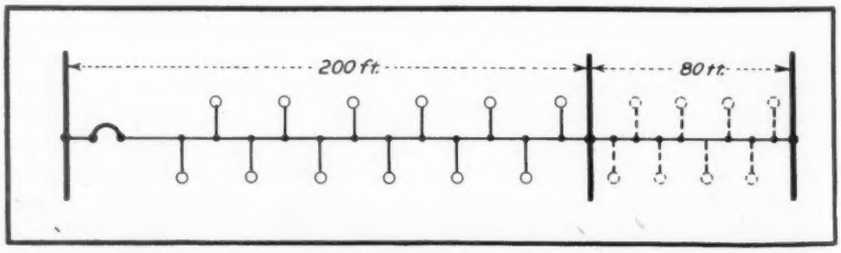
Three-wire, 115/230-volt circuits should be checked to make sure that loads are balanced. Heavy unbalance will result in high neutral current which may be seriously overloading part of the transformer winding. This heavy neutral current might also result in poorer voltage regulation at the extremity of the feeder, giving unduly low voltage on the loaded side and abnormally high voltage on the underloaded side.

Some plants which still have two-wire, 115-volt circuits for lighting may profitably be converted to the three-wire (Edison), 115-230-volt system if heavier lighting loads are being carried. The two active conductors of the 115-volt system should be the outside conductors of the three-wire system, adding a neutral conductor which can be of smaller copper cross-section.

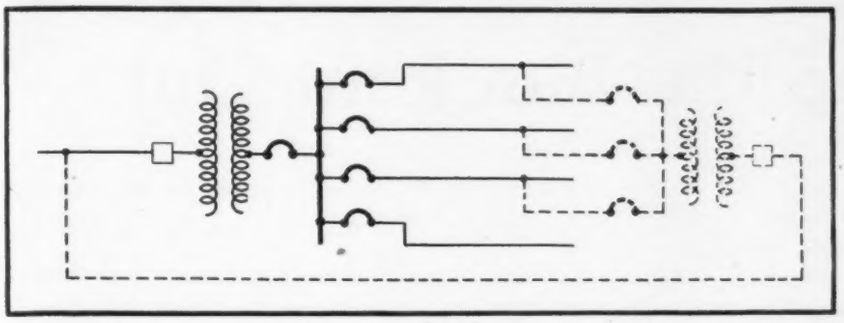
Curing Flicker

There is a solution for the plant engineer with a flicker problem, particularly on 115/230-volt, three-wire feeders, wherein intermittent starting and stopping (or pulsating load) of 115-volt motors may be drawing excessive currents in one side of the three-wire system. A simple move to alleviate this condition is to install a balancing auto-transformer, connected usually at the remote end of the feeder. This balancing auto-transformer will be rated 115/230 volts. It will allow the pulsating current to the 115-volt motor load to be supplied from both sides of the 230-volt wiring, thereby greatly reducing the voltage drop and flicker.

Increased lighting loads in industrial plants make the problem of supplying well-regulated voltage to the lighting load increasingly important. Industrial power purchased from the utility company is not usually regulated as closely as that furnished to residential or commercial customers. To compensate for the regulation of



IF POWER FEEDER (460 volts) with distributed load along its 200 ft. length (solid line) has a voltage drop of 7½ per cent at its end, then if it is extended only 80 ft. (dotted line) with the same size conductor to serve additional distributed load of equal density, the drop will double to 15 percent at the end of the extension



GENERALLY the most practicable way to remedy unsatisfactory conditions on industrial plant wiring and to provide for additions to load is to extend high-voltage supply to oil-less transformers installed at load center; existing power feeders may be cut back and fed from new transformers

the incoming voltage supply plus voltage drop throughout the plant wiring, there is available the air-cooled automatic induction regulator rated at the voltage of the lighting feeder. This can be installed at the load center of the lighting area and 100 percent voltage will be maintained. This is especially important with incandescent lighting, since light output falls off very rapidly with undervoltage. It is likewise important with fluorescent lighting because for proper operating the voltage must be maintained within approximately 7 percent of the rated voltage.

Bottlenecks in power distribution can often be relieved by the proper use of capacitors for power-factor improvement. In many industrial plants existing circuits, transformers and switching equipment can be made to carry additional power load by the application of capacitors to improve power factor.

Major Changes

Eventually, however, the plant engineer may exhaust these remedial measures and be faced with the problem of making major changes. One obvious change in meeting the limitation of plant wiring might be to double up or strengthen the existing wiring. But today there are definite objections to increasing the effective copper cross-section of existing plant wiring circuits. Copper is one of our very critical metals and, apart from the question of inherent high cost and long shipments of copper products, it becomes the obvious duty of the plant engineer to solve his problem by the minimum use of copper.

If the limitation in plant wiring is one of heating, we need only to recall that heating is equal to I^2R to realize that it is more effective to reduce current rather than to increase the effective copper cross-section and thereby reduce resistance (R).

Frequently, the engineer in charge of supplying newly acquired load in the plant may be tempted to accomplish this by extending an existing feeder beyond its original length to reach out and pick up the new load. This usually results in an aggravated wiring condition. The voltage drop at the end of a feeder supplying a distributed load is proportional to the square of the length of the feeder. Thus, a feeder 200 ft. long carrying distributed load such that the voltage drop at its terminus is 7½ percent will—if extended only 80 ft. to pick up additional distributed load—give a drop of 15 percent at its new extremity. This drop would be excessive.

Load Center Supply

In general, the best way to meet the limitations of existing plant wiring and at the same time to take on new loads is to carry a high-voltage supply circuit (at 2,400 to 13,800 volts) directly to the load center and use small step-down unit substations and short secondary feeders.

Transformers (usually three-phase) cooled by non-inflammable liquid or air, together with metal-clad switching equipment employing air circuit breakers on the secondary side, permit locating these small substations within the plant directly at the load center. The load center unit utilizes transformers of relatively small rating, which means smaller secondary breakers, lower values of short circuit on the secondary side and shorter secondary runs.

Carrying the high voltage directly to the load center and using shorter secondaries minimizes voltage and power loss and effects great savings in copper, as well as steel for conduits.

Additional Substations From Shifted Spares

NARROWED MARGIN of spare transformer capacity is a means whereby an Eastern utility is creating the capacity from which to assemble new substations. Several such new stations are being placed where 132 kv. conveniently crosses a leg of the 22-kv. system. The sites are chosen as close as possible to the intersection and so as to afford an unobstructed view from all directions.

In one such station the 22-kv. structure was practically all wood supports and members, the horizontals being largely 4x6-in. timbers. The poles will be set in the ground, no concrete. Disconnects will not be gang-operated, so there will be no concern over possible warping or weaving. The 132-kv. structure will be of steel salvaged from other jobs. The lifting structure will consist of two former 50-kv. towers with a steel beam across for the hoist.

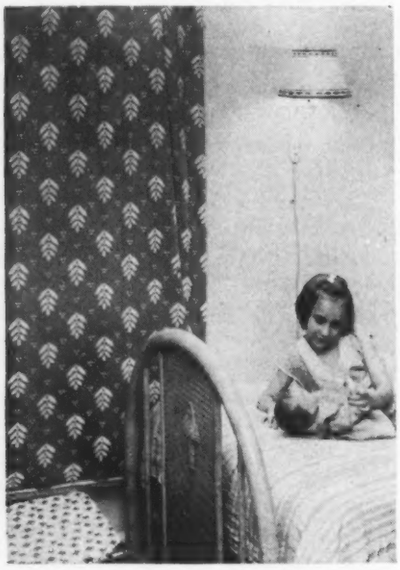
Policy has been to buy relatively large capacity transformers rather than a multiplicity of small ones. This is working out well under present conditions. Thus three of these substations have normally required six 5,000-kva. transformers. Three new 10,000-kva. units are being acquired. One of these will replace the 5,000-kva. spare customarily provided for a set-up that more logically would have three 5,000- and three 10,000-kva. units. The 10,000-kva. spare transformers will permit full capacity of the larger banks and the three released 5,000-kva. units become available for constituting a 15,000-kva. substation elsewhere. Later the 10,000-kva. spares can be similarly used if conditions warrant a 30,000-kva. station and also warrant operating without spares, a portable substation being available for use anywhere on the system.

How to Keep the Blackout Out

Light-tight screening of windows in one or more rooms, possible at trifling cost and of cheerful inside appearance, allows adequate home lighting to be continued

MYRTLE FAHSBENDER, Westinghouse Electric & Manufacturing Company

AMERICAN FAMILIES do not have to sit in the dark during blackouts. And the alternative to that is not necessarily the spending of a lot of money, or even very much, for special curtains and shades. Often it is possible to use materials right at hand at no cost at all or very little. The accompanying pictures indicate what can be done.



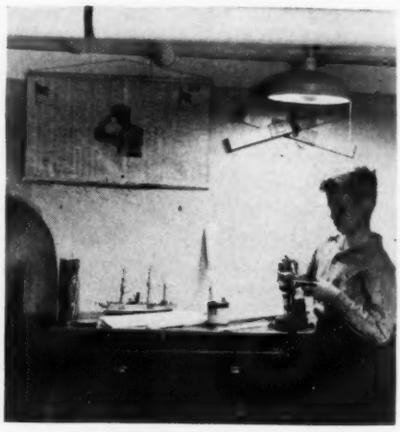
ANYTHING YOU HAVE—Here is a curtain made of a discarded bedspread, held on wood strips top and bottom and thumbtacked to the window frame on the sides

Here are same "Do's" that will provide effective compliance with blackout orders and will help to make the blackout period comfortable. Following them are several "Don't's" that will keep down the cost of blackout provisions.

Do choose a room or rooms—preferably with the fewest windows—as a refuge in case of blackout. (This isn't necessarily the room you'd choose as an air raid shelter, of course.) Remember the bathroom.

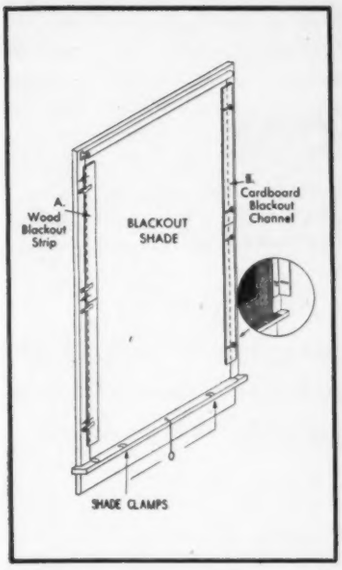
Do cover up windows—and doors if there are any—so that the light inside cannot be seen from the outside. (Venetian blinds and black window shades that hang inside the frame are not sufficient.)

Do have adequate light in the refuge room. Suppose it is the kitchen, with only a ceiling fixture. In order to provide sufficient light for all the members of the family, there must be some local light. Bring a floor lamp or table lamp from the living room.



SIX LAYERS OF NEWSPAPER, wood strips at top and bottom, scotch tape along sides to hold edges of sheets together, make an opaque shade for small windows. Paper must extend well beyond window opening on all sides to make it light-tight and thumb tacks may be needed

CONVENTIONAL black paper shades, costing around 69 cents each, are now available black outside, white inside and with side clips to prevent light leakage (at left). In the view at right brown sateen curtains are hung on a rod and pulled across windows, then buttoned together. During the day they are pulled back behind side drapes. A single thickness hung in full folds is sufficient if used over venetian blinds or dark window shades. Material for these curtains cost $3.92



TWO WAYS to make roller shades light-tight shown at left. At (A) fairly broad wood strip slipped under clips holds the shade against window frame. At (B) a channel of stiff cardboard folds over edge of shade and is held to window frame by screw-eyes. Outer flap of fold is slotted to slip over heads of screw-eyes, which are then turned to hold it down. Ivory colored insulation board, costing about 6 cents per sq. ft., make a pair of panels set into the window frame against quarter-round molding for light-tightness, as appears in center picture. Designs on panels are cut from leftovers of wallpaper used in the room. Any kind of coated cloth that is opaque makes an acceptable shade; may be made up on a roller or tacked on wood strips. At right is a black pyroxylin covered cloth sold at around 50 cents per yard and given a cheerful look by appliques cut from fabric

Don't go off on a shopping spree for blackout materials. Rummage around, first, in storage boxes. Discarded draperies and portieres are often "just the thing."

Don't buy black materials. Dark red, deep blue and brown are quite as effective and not nearly so depressing. Just be sure the material is thick enough so the light won't penetrate. (One very cheerful blackout shade is ecru on both sides with a black filler between.)

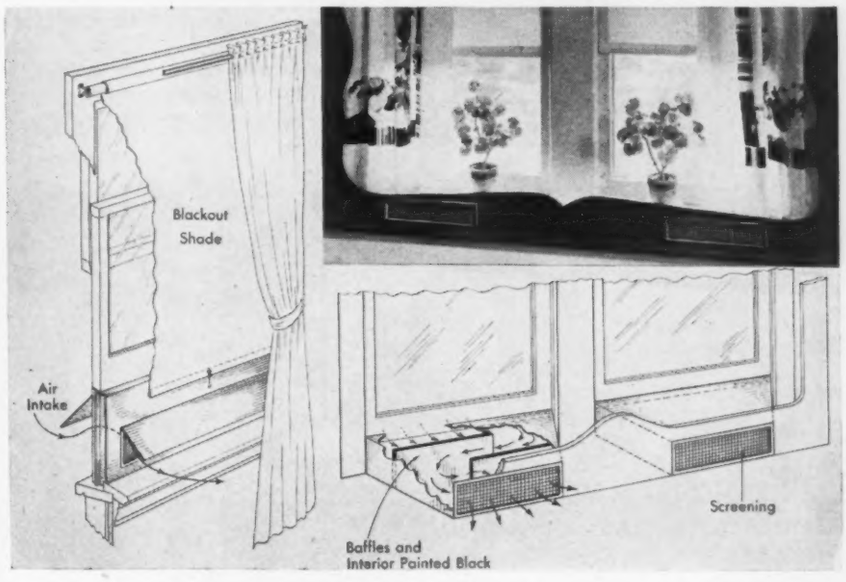
Don't buy trick lighting gadgets.

Don't put black paint on windows. Should there be an air raid, the glass might get broken and the light would stream through.

Don't buy or use colored bulbs in fixtures or portable lamps. Colored bulbs absorb about one-third of the light and produce an unnatural illumination.

Don't buy or use *blue lights*. Experience in England and tests here prove that blue light is more easily seen from the air than any other color.

MADE THE SAME as the newspaper shade, two layers of heavy wrapping paper covered with left-over wallpaper. Decalcomanias make colorful decorations for paper shades



PROBLEM OF VENTILATION remains a problem. Here are two solutions offered, but both are on a cost level considerably above that of improvised blackout curtains. Probably the best and cheapest solution, particularly if father smokes a pipe, is to turn the light out and open windows occasionally

Sell and Repair Appliances From Trucks House-to-House

Kansas City company reports results of two years experience with door-to-door appliance repairs trucks — Finds them stabilizing influence on the revenue and personnel under today's conditions

PAUL K. BERRY, Kansas City Power & Light Company, Kansas City, Mo.

FOR the past two years Kansas City Power & Light Company has operated trucks for the repair and sale of merchandise in the field, as an integral part of its load-building program. Starting with three trucks in 1940, the number has steadily increased until seven are operated at the present time, covering the entire metropolitan area of Kansas City once every three months.

With the restrictions placed on electrical appliances during the war period, the company feels that the continuation of this sales and repair service from trucks in the field may help to preserve sales personnel, maintain revenue and provide customers with a necessary service.

A good sales volume has been realized from use of the trucks, and old appliances have been put back into use, thus maintaining revenue on appliances previously sold, while increasing revenue through additional sales. Although prior to the use of repair trucks the company operated from straight merchandise trucks, no material decline has resulted from combining repair and sales operations on one truck.

It is recognized that the repair truck operation is expensive; how-

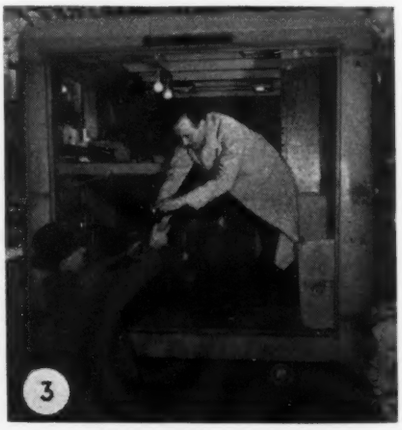
FOUR STEPS in the "at-your-door" appliance repair program used successfully for two years in Kansas City

1. Salesman has just told this customer she can have any faulty appliances repaired in the truck parked at her door. As he takes the iron to the truck he leaves a floor lamp, on which there is a special offer.

2. In the truck the repairman, who also supervises the six or eight men working out of the truck, fixes the iron.

3. Repaired appliances is returned to the salesman.

4. After presenting the customer with the repaired iron the salesman asks what the housewife thinks of the new floor lamp which he left with her.



ever, the load recaptured by bringing idle appliances into use has justified the direct cost of the operation. During 1941, for example, 10,165 items were repaired, all relating to small appliances. Competitive charges for labor and material were made on all appliance repairs made outside of the guarantee period.

List of Repairs

The types of appliances repaired are shown in the following schedule:

	Percent		Percent
Irons	36.81	Coffee makers	4.01
Lamps	19.07	Cords	3.16
Cleaners	10.81	Miscellaneous	2.87
Mixers	6.78	Waffle irons	1.51
Toasters	5.00	Roasters	1.12
Clocks	4.20	Sewing machines	0.56
Fans	4.10		100.00

The idea of repairing appliances from trucks was based on the belief that many appliances needing repairs were idle because some one in the home would not take the trouble to carry the appliance to the repair shop. If a repair service could be taken to the door of the customer these appliances would be repaired and be placed in service. The past two years have transformed this theory into a fact.

Each truck operates in a specified district and is manned by a supervisor, assistant supervisor who also is the repairman and a crew of six or eight men. The truck is driven to a prearranged location in the morning and the crew works from that location in the adjacent blocks. An equal number of salesmen work each side of the street and each house is canvassed. The salesman at all times carries the particular campaign appliance.

Customer entrée

The company has a free renewal lamp service for residential customers and the salesman must first ask the customer for any lamp renewals. Next he asks if the customer has any appliances in need of repair. If the customer has an item to be repaired, it is taken back to the truck and the assistant crew supervisor gives the estimate for the repair. This information is given to the customer by the salesman, who secures permission to make the repair and gives the customer a repair ticket for the appliance. Upon completion of the repair, salesman returns the appliance. If the customer is not at home a form card is furnished for the purpose and delivery is made later. If the repair requires more than 24 hours the customer is advised as to the reason for the delay.

When the salesman returns to the truck for either lamp bulbs or repairs he leaves the campaign appliance with the customer and upon his return begins his sales approach. As the crew moves down the street the truck is moved in order to eliminate delay on the part of the salesmen.

Truck Equipment

The repair truck itself consists of a truck body mounted on standard truck chassis. The over-all body is 13 ft. long, 6¾ ft. wide and 6¼ ft. high. On one side of the truck is a repair bench approximately 10 ft. in length. The repair bench is equipped with grinder and buffer and testing panel. Under the bench is the power plant, consisting of a gasoline motor and a 2-kw. generator, providing lights for the truck work room and sufficient power to operate the various repair devices. Also under the work bench is bin space for appliances being repaired.

On the opposite side of the truck body are located bins for repair parts. These bins are metal with small drawers, the over-all length of the bins being 6 ft. 2 in. in length, 18½ in. in width and 5 ft. 7 in. in height.

Shelves are located along the walls in the forepart of the truck and there is also storage space for merchandise in the front of the truck. One door 28 in. in width opens on the curb side of the truck and two doors equal to the width of the truck open in the rear. A step is located at the rear of the truck for entry.

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Plant Fires Primary Consequence of Bombing

BERNARD HOGBEN, Technical Journalist, British Government

EVENTS have proved that fire causes a high percentage of the total raid damage suffered by power plants, and to counteract this danger fire-watching parties have been organized among the staffs. A number of men and women are on duty one or more nights a week and a rota system is operated so that personnel is available at all times to deal with an outbreak.

Sleeping and feeding accommodations are provided. Bunks are built in shelters and all odd corners of the plant are utilized for sleeping quarters. Besides the provision of ordinary meals for shiftworkers, reserve supplies of food have to be stored in the plants against any emergency.

Since the practice of going to shelters when the siren sounded was discontinued a new system has been put into operation to give warning when raiding aircraft are overhead. On the highest point of the building keen-sighted, alert men are stationed who can be relied upon to give sufficient warning to the workers below in the plant. These men were specially trained by the RAF for their roof-spotting work, and the adoption of this new system has resulted in a very considerable saving in man-hours.

To deal with trouble resulting from war damage, stand-by shifts have had to be brought into operation. Cable-laying and mains gang workers stand by as their own work decreases and are ready to rush off to the scene of any damage which may involve electrical property.

Material Available

Shortages of such essential materials as rubber and gasoline are now being felt in most industries. As yet this has not extended to the electrical utilities. Their need for these materials has priority, and while rigid economy is practiced they have not been deprived of the quantities essential to rendering adequate service.

Editorials

S. B. WILLIAMS, *Editor*

Another New Definition of Interstate

INTERSTATE used to have a fairly simple definition, but when state boundaries appeared to set up barriers to the new regulatory legislation the agencies created to administer these laws found it necessary to make new definitions, and wherever the matter has been carried to the courts the modern definitions have found acceptance. The New River navigable stream decision and the Consolidated Edison labor decision are two notable precedents.

The new note running through current legal interpretation of interstate is not that certain transactions are of themselves interstate, but they are capable of being interstate or they affect or contribute to interstate. Somewhat in this direction is the recent decision of the Federal Power Commission holding Connecticut Light and Power to be engaged in interstate operation, in spite of the fact that it had severed its interstate connections, because energy that did cross state lines went through devices necessary to accomplish conveyance.

This is the first time that the commission has construed transmission facilities as including not only lines but all the equipment necessary to transmitting energy. If this point is upheld it means once more that every utility that generates energy and is tied to any system that sells across state lines is engaged in interstate traffic. It is not possible to plead that the energy cannot be traced in its flow, because modern load dispatching and instruments can and do keep records.

If one wished to maintain complete freedom from federal regulation based on interstate transactions one would find it extremely difficult. Even in such a simple case as FPC jurisdiction it would appear to mean complete severance from other companies. Should that be done the company would have to chance the criticism that its isolation precluded it from taking advantage of interconnection economies and that the customers therefore were being made to suffer. In fact, that very thing was intimated in the Connecticut case. It is a dilemma from which there appears to be no escape.

It must be apparent now that efforts to escape interstate regulation are futile. It has been the intention of the present Administration to erase state lines wherever they interfered with its economic and social program. The cases that are used to make the point are seldom clear cut, but in each there is sufficient to get a decision that in itself can affect the entire industry.

This Connecticut case undoubtedly will be far reaching. If it is upheld by a court of authority, then it would appear that the last fear barrier to a great many interconnections will have been removed.

The Unsung Utility Lads at Pearl Harbor

WHAT IS IT that causes the shepherd to stay out on the hills during the dirtiest of weather to bring in the lambs? What is it that causes the actor, regardless of personal feelings, to go on with the show? What causes the telephone operator to stick to her board when the floodwaters are swirling around her feet? It's the same thing that caused the operating crews of the Hawaiian Electric Company on the Island of Cebu to stick to their posts through the attack on Pearl Harbor?

Is it heroism, is it valor? We don't know, but of this we are sure. Wherever there is electric service we find employees who put the service before their own personal health and safety. In England it was always the electric service that was the first to be restored after a vicious air raid.

And now in Hawaii, in the first sector of American soil to be bombed, we find the utility operating crews upholding all of the best traditions of the industry. Though they had never before experienced a bombing and bombs were falling all about them, they stayed on the job and did as they were directed. On three different occasions they were ordered to shut down the boilers because it seemed too dangerous to keep them going and on three occasions to start them up again.

——And all the time they did not know what had happened to their families and homes.

Still Must Satisfy Local Board for Deferment

LAST WEEK we printed the classification of utility jobs and their ratings for direction of members of local draft boards. It is a carefully prepared list compiled by the Selective Service organization in cooperation with the industry and was designed to work the minimum of hardship to utility companies generally.

But this directive does not guarantee a single deferment.

There is just as much necessity for an employer to satisfy the local draft board on deferment of any employee as there ever was. This directive merely gives the local board guidance. The board cannot just take a fellow's statement as to his job and give him an automatic defer-

ment. It is up to the employer to show the draft board that the employee has a certain degree of essentiality to the company's operations.

As indicated in the classifications, there are certain kinds of jobs which can take high deferment ratings, while there are others that will get very little, if any, deferment. With this list as a guide, it should be possible for any department to plan for replacement now.

There need be no more leaning over backward by employers, because General Hershey's organization has recognized the relative essentiality of certain classes of employees. If the plan does not work it will in all likelihood be because the draft boards were not furnished with the necessary information.

The Blackout Opportunity

FAMILIES living in zones where there may be blackouts still don't know what to do about their lighting and they don't know where or how to find out. In this connection utility companies can do customers a great service and at the same time prevent people from unwisely curtailing their interior lighting by applying the same technique they have used for years in their cooking and other domestic science schools. People want to know and they will come eagerly to lectures that give some facts.

In this issue the whole story is told by pictures. Blackout materials can be as inexpensive or as costly as desired. They need not be dreary nor need they shut out ventilation. The materials can be purchased in most any housefurnishings store and there is no particular trick to making the shields.

Wherever these demonstration lectures have been tried the public has responded wonderfully. They won't sell any appliances, but they will help maintain customer contact and build good will.

The Small Industrial Customer

ONE of the most perplexing problems to utilities is the small manufacturer. He is faced with shutdown because he has no war contracts. He doesn't know how to go about getting them and is easily discouraged when he does not have success immediately he tries to land a contract.

Those small manufacturers may not use as much energy as a few very large war factories, but they have been the backbone of the industrial business. They do not enjoy the very low rates of wholesale customers and because of diversity they altogether make an attractive market for power. Their employees frequently are better anchored to their jobs and the resultant residential usage is very much worth while.

Because they are small the physical job of converting them to war work is not great. The same will be true when peace-time conversion comes. They are flexible and can get under way quickly. Nevertheless, their smallness prevents them from having an organization that can comb the field for work and so they need help.

There are several stories of successful measures taken by power companies to help these small manufacturers get war work. The utilities are in fact about the only people to whom these industrials can turn. There is no formula except constantly selling the facilities of these small customers, finding a way of being in on the ground floor for information, not getting discouraged, seeking out the local prime contractors, and in general leaving no stone unturned.

Every customer saved can be turned to good account, and his employees as well, because it means just so much less war dislocation of the local economy. It is an opportunity to build more solidly in the community—and, of course, the companies should not be bashful in letting folks know what they are doing to help these smaller manufacturers.

Leaks From Closed Sessions

REPRESENTATIVES of manufacturers go to most of the meetings of technical committees of the electrical industry. They are not always accorded the privilege of sitting in at the deliberations because the utility engineers feel that they should be able to talk candidly about their mishaps as well as their successes without the restraints imposed by eagerly interested visitors.

Somehow, however, these closed-session remarks get circulated almost as effectively as if the walls were dictaphones. Candid committee reports not designed for release or disclosure seem to leak out and lead to perversions, sometimes for competitive purposes, of the frank experiences with equipments that the committee is trying to study for the benefit of the industry.

This isn't so much a matter of ethics as it is just plain human nature, and that is something that cannot be changed. Therefore, since this situation seems to be disturbing to some committees, perhaps there is something to be gained by removing as much of the secrecy as possible from these meetings by giving more publicity to their surveys and reports. Discretion may be required to avoid too specific mention of specific products. Nevertheless, the lessons learned about certain trends in design and practice can be stated in functional terms, so as to shorten for the whole industry the period of evolution to bettered performance.

In these days, when every one is crowding his equipment, applying preventive maintenance and doing everything to get better results with less, every committee in every association owes it to the industry more than ever to pass around what it has gathered and digested. If it is done right it will also remove that bugaboo of fear that one producer will somehow take a bit of unfair advantage over the other fellow who is feeling his way to a product proofed against the occasional deficiencies which get reported and noised around.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

SEC Thinking on All-Common Stock

THE inferred end result of the Securities and Exchange Commission policy laid down in the edict to Commonwealth & Southern to convert to an all common stock capitalization is the virtual disappearance of the holding company from the electric utility field.

Furthermore, the procedure is construed as "painless" and direct. As soon as the holding company is on a common denominator basis to all its investors, the next step will be to suggest "passing out the tickets"—meaning distribute the operating company holdings—to bring about compliance with the disintegration requirements of the Holding Company Act. There's no fuss and no muss, and the argument is that the investor has eliminated one plateau of administrative expenses between gross revenues and his dividends without losing equity.

Aimed at Extinction

This appears to be the pattern that SEC's recent emphasis upon the corporate recapitalization clauses of the "death sentence" act will have at the holding company level. Effect of this shift in emphasis from the physical disintegration provisions of the law in the operating company field was the subject of this page a month ago.

At SEC it is generally conceded that the all-common policy applied to holding companies will bring about dissolution sooner or later, if not in compliance with physical disintegration then because of pressure from stockholders seeking to reduce overhead. It is felt, furthermore, that on the whole this is desirable.

Can it be shown that the commission's policies are deliberately directed at extinction of the holding company?

Well, a substantial case can be made out. It was over a year ago that the utility division staff, then under Joseph Weiner, suggested subtly that if C&S itself were to dissolve there would be no SEC jurisdiction left because its component operating units all are intrastate companies. In other words, said the staff then, if C&S will commit suicide it will end its trouble in trying to meet the "death sentence" provisions. Again, in the Engineers Public Service blueprint, the Weiner staff argued that if EPS reduced itself to one of two possible "principal" holdings there would appear to be no reason for the continued existence of the holding company.

There is no difference in the underlying philosophy of the utilities division staff which wrote those blueprints in 1941 and the staff at Philadelphia today. Indeed, most of the current staff had a hand in formulating those reports.

It is also true that the SEC has been subjected to an increasing barrage of pressure from utility security holders who have been inoculated with the germ of suspicion that a holding company merely siphons off revenues which otherwise would be dividends (if, today, they didn't become excess profits taxes). More and more often the remark is heard at SEC, too, that holding company executives are fighting mostly to preserve fat jobs, while the security holders are fighting to get adequate returns on non-voting securities.

Staff Rules

SEC, however, has come to its current policy largely by force of circumstance, because other avenues of approach toward dissolution of holding company systems were blocked by events beyond the commission's control.

There was, in the initial period after the act was passed, the interval in which utility companies probably could have taken the initiative and won acceptance of any reasonable plans for meeting the Section 11 terms by swapping properties among themselves to set up closely knit regional systems. That was at the time of Chairman Douglas' overtures for the industry's cooperation.

About two years ago began the era in which the utilities staff wrote its ideas of how the act must be applied in blueprints for several major systems. The result of this was the narrowest of all constructions of the disputed geographical integration provision, which ended any chance there might have been for extended trading of properties—particularly when the Weiner staff suggested that even the statewide C&S properties in Alabama and Georgia might each be too large for integrated management.

No Market

If properties could not be traded, however, they could still be sold to people in the communities they served. Or could they? The record of the last year has proved conclusively that they could not, at least at this time. The market would not, could not, absorb a redistribution of utility ownership. So well is this recognized now that recently Commissioner Edmund Burke said he doubted if the commission would permit wholesale selling of utility properties on the market now.

But, if utility ownership cannot be shifted on the stock market, couldn't it be shifted by giving to the holding company security holders, pro rata, the operating company securities in the top company portfolio? The answer to that question is the key to the SEC shift in emphasis to the corporate recapitalization of the law.

It can be done, it is felt at SEC, if the holding company is reduced to the common denominator of an all-common-stock security issue; it will be easy then to show stockholders that their 100 shares really means ownership of a definite number of shares in each of the operating companies. Thus is the stage set for the suggestion that the holding company simply "pass out the tickets" and fold up shop. Increasing costs and taxes are playing right into SEC's hands in this respect by multiplying the dissatisfaction of holding company security holders with their return.

NEWS OF THE WEEK

New Transformers Strictly Limited

WPB power branch instructs staff to follow NEMA suggestions for material conservation through overloading methods, utilization of spare capacity and taking advantage of local conditions

Priorities for new transformers are being rigidly limited to absolutely essential needs where all other means for getting the job done with existing equipment have been exhausted. Spare transformer equipment is no longer permitted to be installed—even on direct war loads.

The WPB power branch no longer permits installation of new units until the full benefit of overloading existing equipment by additional cooling equipment has been obtained. On this point, Barkley Sickler, the power branch priorities chief, has instructed his staff to follow the recent suggestions of the NEMA transformer section.

NEMA's section, in the interest of conserving critical materials, has suggested that existing equipment could be more effectively utilized by these means: (1) Addition of blower or water spray equipment to oil immersed self-cooled transformers, or (2) addition of forced oil circulation to oil immersed self-cooled or water cooled transformers. Heat exchangers, in the latter instance, may be either air or water cooled.

The section stated that in some cases blower equipment adds up to one-third to the output while water spray may increase up to 60 percent. Forced oil circulation will sometimes increase transformer output by two-thirds. Amount of overload that can be secured on existing transformers by this auxiliary equipment, the NEMA group reported, depends upon the design and the present condition. It is recommended that utilities check with manufacturers relative to individual applications.

The Sickler instructions to the priorities staff also direct that utilities be required to install three-phase transformers for three-phase loads.

The NEMA transformer section also touched upon this in its report, suggesting the avoidance of excessive spare capacity by utilizing existing spare single phase transformers in new banks of three single-phase units and by using three-phase transformers for three-phase loads, except pole type. Where this is done, NEMA suggested servicing transformer substations with a portable transformer substation.

Touching upon the K.V.A. rating, the NEMA report recommends basing the rating on the standard 55 C. temperature rise, taking advantage of average annual cooling medium temperature, which is less than 30 deg. C., and taking advantage of the many instances where the average loading is below the peak. For a given application a transformer of 3 percent smaller K.V.A. rating can be used for each 10 percent the daily average load factor is below 100 percent, down as far as 50 percent.

HONOR P. G. & E. MEN IN SERVICE—P. M. Downing, vice-president and general manager of the Pacific Gas & Electric Co., dedicates a flag to more than 800 P. G. & E. employees now serving with the armed forces. All employees of the company serving in the armed forces are assured of their jobs back when the war ends, with all rights preserved, Mr. Downing declared

NEWS BRIEFS

BREAKAGE OF A 50-TON CASTING in one of four turbines at the Alabama Power Co.'s Jordan dam removed that unit from power production on June 2. Loss of the turbine, which will be out for several months, would not materially affect power supply to north Alabama industries, according to J. M. Barry, vice-president and general manager of the company, since the dry season is beginning and the three other turbines at Jordan normally will be able to handle the full flow of the Coosa River.

JOHN W. HOUSER, director of the utilities division of the Securities and Exchange Commission, suffered a fracture of the hip last week when he was thrown from a horse he was riding near his Philadelphia home. He is expected to be away from his desk for several months.

FISHING ON BOCA RESERVOIR on the Truckee Storage Reclamation project in Nevada-California is to be restricted for the duration of the war. The move was taken by the Department of the Interior to protect the dam and other structures from sabotage.

WORK HAS BEEN COMPLETED on the North Little (Ark.) change-over from 2,400-volt delta to a 4,160-volt wye system. V. H. Beal, city electrical engineer, predicts a 300 percent increase in efficiency in the new system, preparation for which has been under way for three years.

ERECTION OF THE NEW PLANT of the Calgary Power Co., near Alberta, is now practically completed. The new power and storage project involves an expenditure of about $3,000,000 and covers the power development of Lake Minnewanka.

THE USE OF BICYCLES in place of autos in every possible phase of operations and quarterly meter readings have been announced by the Eastern Shore Public Service Co. for the duration. Both measures are designed to save rubber and gas, it was said.

"MINES ABOVE GROUND" is a new Western Electric two-reel motion picture which dramatizes the results of scrap metal salvaging operations in the Bell System. More than 75,000,000 pounds of junk metal was salvaged in the system last year, according to P. L. Thomson, director of public relations for Western Electric.

"YOUR COMPANY—A HANDBOOK FOR EMPLOYEES" is the title of a new booklet published by the Employee Information Program of the Georgia Power Co.

A POSITION is open on the New York editorial staff of "Electrical World." Correspondence is invited from electrical engineers with utility experience and some facility in writing. Complete personal details, including salary level and selective service status, should be submitted with letter of application. Address all replies to the editor.

Pennsylvania Electric Seeks to Buy Keystone

Joint application has been filed with the Pennsylvania Public Utility Commission by the Pennsylvania Electric Co., Johnstown, and the Keystone Public Service Co., Oil City, asking approval of the commission of the acquisition by Pennsylvania Electric of the franchises and properties of Keystone.

The territories now served by the two companies include the counties of Cambria, Centre, Clarion, Clearfield, Crawford, Erie, Forest, Indiana, Jefferson, Somerset, Venango, Warren and Westmoreland. The territory is contiguous and Keystone now relies upon Pennsylvania Electric for a substantial portion of its total energy requirements, it was stated in the application.

Under the proposed purchase, Pennsylvania Electric would assume all the debts and liabilities of Keystone and, in consideration, would receive a cash settlement.

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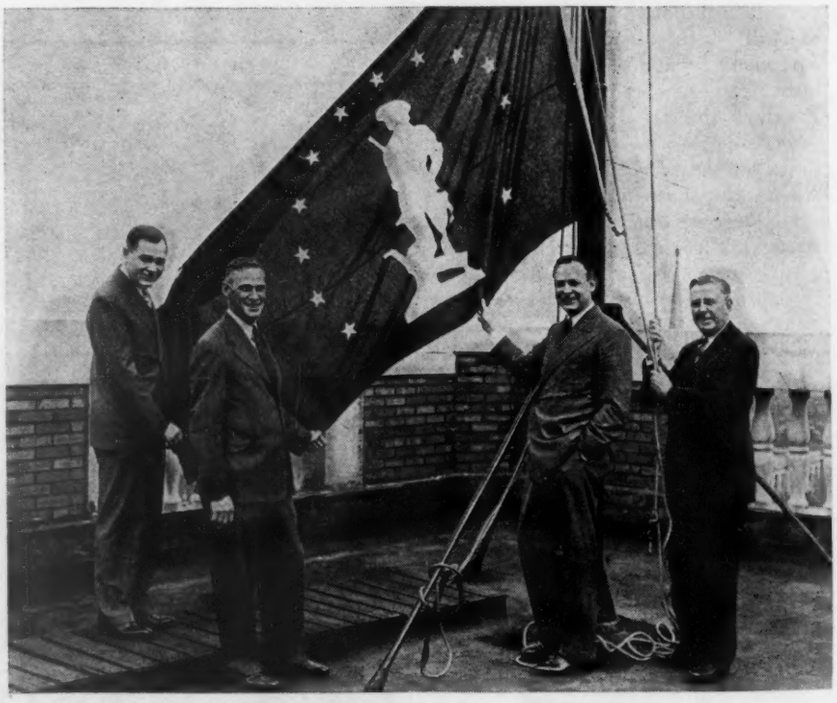
Utility-Cooperative Plea Dismissed by Board

Federal Power Commission has dismissed for want of jurisdiction an application filed by the Florida Power Corp. for authority to sell certain electric properties located in Gadsden and Leon counties, Florida, to the Talquin Electric Cooperative, Inc.

The order states that the properties involved in the transaction which are subject to the commission's jurisdiction are not shown to be the whole of the company's facilities subject to the jurisdiction of the commission or to have a value of more than $50,000. Thus the transaction is not within the scope of Section 203 of the Federal Power Act, according to the commission ruling.

The commission made note of the fact that the application stated that the sale is proposed to be made under an agreement of April 22, 1942, between the utility company and the cooperative for a total price of $128,599 cash, the net cash proceeds to be used by the applicant for corporate purposes.



MINUTE MAN AT JACKSON—Proudly raising the Treasury Department's Minute Man Flag over the Consumers Power Co. offices in Jackson, Mich., are: President Justin R. Whiting (at the lanyard), and, left to right, Dan E. Karn vice-president and general manager; M. Wilson Arthur, vice-president, and Walter H. Sammis, vice-president. More than 98 percent of the company's 5,000 employees have subscribed to purchase War Bonds

San Diego Receives the Charles A. Coffin Award

Puget Sound Power & Light wins double honors with Modern Kitchen Bureau and Martin agricultural prizes; nine groups of awards made companies and individuals at annual meeting of the Edison Electric Institute

Outstanding accomplishments by companies and individuals in the electric industry were recognized by the presentation of nine groups of awards during the annual meeting of the Edison Electric Institute, June 11. Announcement of the awards was made by H. P. Liversidge, president of the Philadelphia Electric Co. and chairman of the prize awards committee.

Coffin Award to San Diego

For its splendid performance in meeting greatly increased industrial and defense loads and serving a large added population, the San Diego Gas & Electric Co. received the Charles A. Coffin Award, established in 1922 in memory of General Electric's founder, the late Charles A. Coffin. Top ranking prize, it goes to the company each year "achieving the greatest advancement in its operation and physical plant, thereby making a distinguished contribution to the development of electric light and power for the convenience of the public and the benefit of the industry." A gold medal, certificate and $1,000 in cash for the employee's benefit go with the award.

MKB and Hughes Award

Puget Sound Power & Light Co., Seattle, won the Modern Kitchen Bureau's first prize of $500 for "the greatest contribution to the development of the domestic water heating load during 1941. Second prize of $300 went to West Penn Power Co., Pittsburgh, and third prize of $200 to the Knoxville Electric Power & Water Board.

The George A. Hughes Awards, for the greatest contribution to the development of the electric range market through direct or cooperative promotion, saw first prize, a silver trophy and $500, go to the Pacific Gas & Electric Co. and second prize to the West Texas Utilities Co., Abilene, Tex.

Curtis Lighting Award

Ohio Public Service Co. won first prize in the Augustus D. Curtis Award, presented to the company showing "the most distinguished contribution to the advancement of high levels of artificial illumination in interiors of commercial buildings." Walter C. Schultz was the recipient of the certificate and $200 in cash. Second prize went to Howard M. Sharp of the Buffalo Niagara Electric Corp., third prize to E. B. Richey of the Birmingham Electric Co. and fourth prize to Jesse C. Anderson of the Central Illinois Light Co., Peoria. New York Power & Light and Wisconsin Public Service won honorable mentions.

Five Other Awards Made

Puget Sound Power & Light came in for its second honor with the winning of the Thomas W. Martin Award, a bronze plaque presented to the company showing the greatest contribution to agricultural advancement.

Dallas Power & Light Co. won the Reddy Kilowatt Award for the best example of a humanized annual stockholders' report.

The Laura McCall Awards for home service achievements went to Marguerite Reinhart of the Idaho Power Co., who took first prize; Mrs. B. E. Marsh of the Nebraska Power Co., second, and Mrs. Harriet G. West of the Oklahoma Gas & Electric Co., third prize.

A repairman, Ralph Jackson, employed by the Kentucky Utilities Co., at Pineville, Ky., won the Claude L. Matthews Valor Award for "acts of devotion where extraordinary courage has been exercised." Jackson swam an icy river last winter near Harlan, Ky., carrying a rope spliced to the repair lines and enabling service to be restored to the town of Harlan.

First prize in the James H. McGraw awards for the best paper on an engineering or technical subject went to C. H. Lindell of the Cincinnati Gas & Electric Co. The award carried a $250 prize. Charles J. Betts, Jr., of the Westchester Lighting Co., Mt. Vernon, N. Y., received the second prize and K. J. Affanasiev of the Pennsylvania Water & Power Co., Baltimore, the third prize.

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United Light Files to Sell Subsidiary

United Light & Power Co. filed last week with the SEC a plan providing for disposition of its interest in the Point Pleasant Water & Light Co. (W. Va.) as a step toward compliance with integration orders under the holding company act. Under the proposed plan, Point Pleasant would be sold to the Appalachian Electric Power Co., a subsidiary of American Gas & Electric, at a purchase price given as $379,000.

Upon completion of the transaction, Point Pleasant's net assets are expected to approximate $408,000, which would be distributed to the parent company, Columbus & Southern Ohio Electric Co., upon surrender by Columbus of the subsidiary's outstanding securities. These securities would be canceled.

•

FPC Authorizes Maryland Merger

Authorization for the merger of facilities of the Eastern Shore Public Service Co. of Maryland with those of the Delmarva Power Co., on the former's application, has been granted by the Federal Power Commission.

According to the order the Maryland company will acquire the assets of the Delmarva company, consisting of cash, receivables and inventories, and a 19,500-kw. steam generating station, located at Vienna, Md., with its transmission facilities. The Maryland company also proposes to issue $1,750,000 in aggregate principal amount of its first mortgage bonds, 4 percent series, due in 1969, and 4,500 shares of common stock for delivery to Eastern Shore of Delaware, in exchange for all of Delmarva's outstanding bonds and stocks now held by Eastern Shore of Delaware.

•

Aluminum Plant Gets Hetch Hetchy Power

Negotiations for sales of Hetch Hetchy power to the Federal Defense Plant Corporation were completed early in June and it is expected that the war industry will be in operation by next February.

The contract, which has been signed by the corporation and San Francisco city officials, calls for delivery to the aluminum plant of 100,000 kw. Power above the 85,000 kw. capacity of the city plant will be secured from Pacific Gas & Electric Co., with P. G. & E. supplying the additional energy at the same rate the city is selling power to the aluminum plant.

Income to the city will be $2,400,000 annually, the amount now received from sale of the power to P. G. & E.

A stay of execution until the aluminum plant is in operation is expected on the injunction against continued sale to P. G. & E., effective July 1.

New Construction to Be of "Temporary" Character

Chairman Donald Nelson of WPB calls for a "bare bones" policy for all new building; power branch re-examining approved utility projects to see if they comply with new rulings

Construction of new facilities for the duration of the war is to be "of the cheapest, temporary character with structural stability only sufficient to meet the needs of the service which the structure is intended to fulfill during the period of its contemplated war use."

This is the language of WPB Chairman Donald M. Nelson's directive putting into full effect the new war policy of reducing to a "bare bones" basis all new building so that the maximum of raw materials will be available for turning out the weapons of war (ELECTRICAL WORLD, May 30, 1942, p. 126). The directive applies with equal force to war plants and to private building, including that of utilities. The power branch is now re-examining all approved utility projects to determine, in the light of the new program, whether each job is to be done and if so whether all the corners have been cut on specifications.

Seven Criteria to Be Met

All new construction must meet seven criteria set up in Nelson's order, which is approved by the Secretaries of War and Navy. The job must be found essential to the war effort and it must also be found affirmatively that postponement of construction would be detrimental to the war effort.

The third hurdle is a determination that it is not "practical" to rent or convert existing facilities for the purpose. In the electric power field "conversion" means full curtailment of non-essential civilian loads. Fourth criteria is that no other job under construction or about to be built could be utilized.

The next two requirements involve specifications—all non-essential items and parts must be deleted and the remaining parts designed of the simplest type, "just sufficient to meet the minimum requirements." Finally, it must be found that there is sufficient labor, transportation, materials, utilities and the like available both to build and to operate the plant, and that the product can be used at once or stored until needed.

Enlarging upon the matter of specifications, the directive specifies that the guiding principle for all work will be to "utilize those materials which are most plentiful and which, in the ultimate analysis, will cause the least interference with the production of combat materiel." For instance, wood frame buildings are to be preferred over reinforced concrete, reinforced concrete over steel frames. Mechanical and electrical features of plants must be reduced to bare essentials; air conditioning, except as required for manufacturing processes, is specifically barred. Electrical systems must be of the simplest design.

Generally speaking, it is planned that practically all construction work which cannot be finished by June, 1943, will be abandoned and that projects now contemplated for building in that period will be reduced as much as possible. There will be exceptions, of course; no flat cutoff date is anticipated ever for utility generating facilities, but deliveries of units after next spring —those not now being fabricated—will be held to a minimum consistent with the Nelson directive.

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Quit Construction on Virginia Plant

The Virginia Electric & Power Co. has been forced to abandon construction of the $4,000,000 addition to its Reeves Avenue power plant at Norfolk, Va., Jack G. Hotzclaw, president of the company, said recently, because of the inability of the company to obtain necessary priorities for the work. The company had already spent $200,000 on the project. The turbine for the Norfolk plant is of special design, he pointed out, which made it difficult to get a WPB rating.

Construction on the $6,800,000 steam plant, announced May 21 to be built on the James River, in Chesterfield County, about 10 miles east of Richmond, is going ahead, however. The turbine for the Richmond plant is of standard design and no trouble on material priorities is anticipated because of the critical need for wartime power needs in the area.

In the meantime a satisfactory agreement has been reached between Virginia Electric & Power and a group of contractors engaged in the private construction of defense houses in the Norfolk-Portsmouth area. The disagreement resulted from the issue of supplying utility services. Under the new agreement the power company will bear the cost of installing mains required to furnish gas service to the housing projects now being constructed. Priority restrictions were the primary cause of delay in the first place, it was said, and utility officials claimed that more than 5,000 family dwellings in the Norfolk area had been connected under the defense program.

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Line Severance Did Not Bring Immunity

Maintaining that belated severance of some interstate connections, when the Federal Power Act became law in 1935, did not bring immunity from regulation, the Federal Power Commission has directed the Connecticut Light & Power Co. to comply with requirements of the uniform system of accounts and to file within 90 days the accounting and original-cost studies called for under Electric Plant Instruction 2-D of the System of Accounts and a supplementary accounting order issued by the commission in 1937. The opinion stated:

"By discontinuing these interconnections or interstate transactions by means thereof, at Groton, Portland and Torrington, respondent impliedly recognized that it had been subject, or at least that it probably would be held to be subject, to the regulatory provisions of the act; *i.e.*, that there was interstate energy supplied at those interconnections, and that respondent owned or operated facilities for the transmission of that energy."

The opinion points out that the company, when it severed the connections, admittedly did so to avoid being held subject to the commission's jurisdiction. Answering the company's argument that its operations were not interstate in character because it did not own the facilities actually crossing the state boundaries, the term "facilities for transmission" is construed as including "not merely the wires by which energy is conveyed in bulk over a distance but all the devices necessary and useful to accomplish that conveyance," including step-down substations, synchronous condensers and appurtenant facilities.

In brushing aside the Connecticut Light & Power Co.'s contention that it is subject to regulation by the Federal Power Commission, the opinion held that such contention "must be rejected" on the basis of previous commission and court decisions.

C. & S. to Appeal SEC Stock Order

Commonwealth & Southern Corp. filed, last week, with the Circuit Court in Philadelphia an appeal from an SEC order directing the utility to reduce its capitalization to a single class of common stock, under the provisions of Section 11 (b) (2) of the holding company act. The appeal will be taken, company officials said, primarily to place the company on record, within the prescribed legal time, as opposed to the commission's action denying the company a rehearing on the one-stock order (ELECTRICAL WORLD, May 23, page 5).

Commonwealth & Southern filed a plan with the SEC last year which provided for its retention of the Southern group of subsidiaries and for the exchange of the Northern subsidiaries for the outstanding shares of its preferred stock. SEC has taken no action on this plan.

Last month company directors took no action on the quarterly dividend on the $6 preferred stock, due July 1. On "half pay" since 1935, arrears on the issue will amount to $23.25 a share on July 2. With 1,500,000 shares outstanding, this means a total arrearage of $34,875,000. Inability of the company to earn its dividend, despite record sales of power and gross revenues, is said to be back of SEC's insistence on a revamping of the capital structure. The commission has contended that the common stock has no value because the preferred arrears represent a claim on the assets of the company which, when added to the liquidating rights of the stock, exceed net value.

•

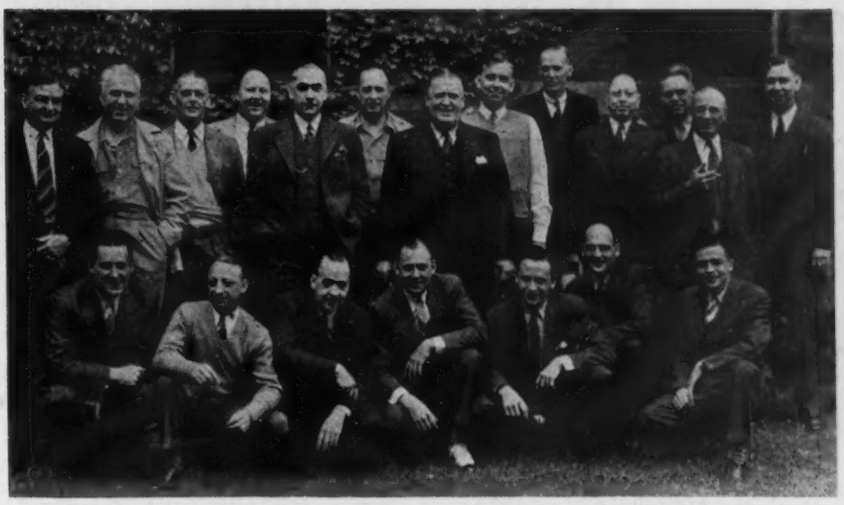
Middle West Change Ordered by SEC

Denying a plea that dissolution proceedings be withheld until after the war, SEC last week rejected a Middle West Corp. plan for consolidation of Central & Southwest Utilities Co. and the American Public Service Co. and directed that either of the two subsidiary holding companies be dissolved and that securities of both be reduced to a single class of common stock. The two companies received one year in which to comply with the order.

On the matter of compliance with the commission's order during wartime, the companies had argued that the prospect of higher excess profit and income taxes would have a depressing effect on the company's net incomes and that the cost of labor, material and supplies would make it impracticable to arrive at a valuation of the companies' investments. The SEC pointed out, however, that expectation of decreased earnings made it all the more necessary to disallow any plan to issue preferred stock as suggested in the plan of consolidation.

The voluntary plan filed by the companies, under Section 11 (e) of the Holding Company Act, had proposed that both Central & Southwest Utilities and American Public Service would cease to exist after their consolidation and that their assets and liabilities would be assumed by a new corporation to be known as the Central and Southwest Corp. Existing priorities and preferred stocks of Central and American would be eliminated and the outstanding capital stock of the new corporation issued in exchange would consist of single classes of common and preferred. The new corporation would have had the power to issue 1,750,000 shares of $100 par value 5½ percent cumulative preferred and 1,500,000 shares of $15 par value common. SEC announced, however, that it was rejecting the plan "because of the unsoundness of the proposed capital structure." Any reorganization of Central or American, they pointed out, must be on the basis of a single capitalization consisting only of common stock.

Middle West Corp. is the successor of Middle West Utilities Corp. Central's subsidiaries include Central Power & Light, Southwestern Gas & Electric and Public Service of Oklahoma, which operates Southwestern Light & Power. American has one operating subsidiary, West Texas Utilities Co.



WAR PRODUCTION CONFERENCE—Resident engineers of the F. W. Wakefield Brass Co., lighting equipment manufacturers, attended a War Production Conference at the plant recently. Above, standing: A. F. Wakefield, H. A. Auchter, M. L. Whitman, C. E. Robinson, Jr., T. G. Carroll, H. I. Kenney, H. H. Mallon, Paul Hogan, Jr., W. H. May, S. P. Russell, H. M. Hudson, G. Southern and F. I. Wilson. Kneeling: F. P. Walter, Miller Kleine, Thad Stevens, E. D. Jones, L. J. Hartman, H. Wallace and T. D. Wakefield. Guest speakers were R. C. Kinney of Graybar and R. F. Hartenstein of Ohio Edison

Santee-Cooper Denied Rehearing

A petition by the South Carolina Public Service Authority for a rehearing on an injunction forbidding the authority's purchase of the South Carolina Electric & Gas Co. and the Lexington Water Power Co. (Associated Gas & Electric subsidiaries) was denied by the state Supreme Court recently.

Santee-Cooper had asked a rehearing of the injunction on the grounds that the court should clarify the position of the authority in regard to purchase of completed and existing utilities east of Camden and Columbia, S. C. The court, assuming original jurisdiction, had decided several weeks ago (ELECTRICAL WORLD, May 23, page 6) that the authority was without power to acquire the utilities.

PWA, which financed, to a large extent, the $57,000,000 development, has asked Gov. R. M. Jeffries to call a special session of the Legislature to pass an act enabling the authority to buy the properties.

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REA Units Make Advance Payments on Loans

Announcement has been made by the U. S. Department of Agriculture that, during April, 35 rural electric distribution systems in fourteen states made advance payments totaling $135,112 on construction loans obtained from the government through the Rural Electrification Administration.

Bone Predicts Local Condemnations

If Congress fails to pass legislation creating a Columbia River Power Administration, with authority to buy out private utilities in the Pacific Northwest, local agencies will take over these properties piecemeal by condemnation, Senator Homer T. Bone, Washington Democrat, predicted this week.

Senator Bone made his assertion while testifying in behalf of pending legislation bearing his name and that of other Washington Congressmen to amend the Bonneville Act in such a way as to set up an Ickes-controlled TVA around the Bonneville and Grand Coulee hydro dams (ELECTRICAL WORLD, April 11, 1942, page 5).

This testimony was seen as an attempt to induce utilities to accept the lesser of two evils and not oppose the proposed power administration. The hearings were held before a joint committee, but neither House nor Senate committee has yet reported any bill to the floor for debate.

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Taxes Offset Net Gains in California

Revenues of eleven major California utilities were up 7.9 percent in 1941, but operating costs, taxes and depreciation increased 12.2 percent during the year to more than offset the gain, it was reported to the California Railroad Commission recently by Loren W. East, research engineer for the public utilities department.

Total operating income for the eleven companies in 1941 was $350,127,456; expenses totaled $254,859,991. Operating and maintenance costs were up 10.4 percent, taxes 20.6 percent and depreciation accruals 5.9 percent.

The survey included the following companies: Pacific Gas & Electric, San Diego Gas & Electric, Coast Counties Gas, Southern California Edison, California Electric Power, Southern California Gas, Southern Counties Gas, Pacific Telephone & Telegraph, Southern California Telephone, Associated Telephone and Consolidated Telephone.

Classification revealed that electric utility revenues increased 5.4 percent, gas 7 percent and telephone 11.8 percent.

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Whatcom PUD Gets No Bids on $5,875,000 Issue

The Whatcom County PUD, which holds condemnation price on local facilities of the Puget Sound Power & Light Co., failed recently to receive any bids on $5,875,000 of revenue bonds it planned to issue.

Whatcom district commissioners blamed "awards larger than the facts justified," delay due to legal action which has added over $500,000 to interest and war conditions for inability to finance the acquisition. It is believed that the failure of the Whatcom PUD financing points to similar difficulties in Lewis, Thurston and Cowlitz counties, which have similar condemnation prices.

•

Indiana Association Will Hold Business Meeting

Due to war conditions, the Indiana Electric Association will break the precedence of long years standing in holding its annual meeting in French Lick. The dates for the meeting have been canceled and instead a strictly business meeting will be held at the Indiana War Memorial Building in Indianapolis on the afternoon of Thursday, September 24, with morning and afternoon sessions on Friday, September 25. The banquet will be held on Thursday night in the main dining room of the Indianapolis Athletic Club.

•

Electric Group Forms Emergency Committee

Formation of a special emergency committee of the electrical committee of the National Fire Protection Association has been approved by the board of directors of the association. The personnel of this special committee includes: Alvah Small, chairman; V. H. Tousley, secretary; L. F. Adams, George Andrae, E. A. Brand, M. M. Brandon, Paul Ferneding, R. L. Lloyd, James D. Lynett, W. J. Mahan and A. H. Schirmer.

MEETINGS

Previously Listed

Public Utilities Advertising Association—Annual convention, Hotel Commodore, New York, N. Y., June 22-24, E. N. Pope, secretary, Carolina Power & Light Co., Raleigh, N. C.

American Society for Testing Materials—Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

American Institute of Electrical Engineers—Summer meeting, Drake Hotel, Chicago, Ill., June 22-26. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

American Society of Agricultural Engineers—Summer meeting, Milwaukee, Wis., June 29-July 1. Raymond Olney, secretary, Saint Joseph, Mich.

Society for the Promotion of Engineering Education—Annual meeting, Columbia University, New York, N. Y., June 29-July 2. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

Power Men Advised to Prepare for L-94

Consensus regarding power limitation order L-94, as summed up by L. Marshall, Jersey Central Power & Light, at the meeting of the Interstate Power Club in New York, June 8, was that electric utilities had better get set for application of the order to their service territories because there will not be much time for preparation after a power shortage area has been declared. As a preview of what the power salesman may expect from the application of L-94 to his customers, E. A. Brand, Buffalo, Niagara & Eastern Power, related experience in the Niagara Falls area under limitation order L-46, which applied only to 25-cycle service. Mr. Brand said it took a long time to prepare to apply the order, compiling lists of customers and classifying them as to loads, productions, etc., and in general to get the machinery going. He gave unstinted credit to the power branch of WPB for intelligent and understanding work in applying the order.

Determining Curtailable Loads

Indicating the vast amount of work required in surveying industrial customer conditions and in analyzing and collating the data so secured were the talks by Morrison Blake, Philadelphia Electric, and J. H. Pilkington, Consolidated Edison of New York. Mr. Blake disclosed the methods used by his company in determining curtailable loads in both war production and other industries and Mr. Pilkington gave a detailed exposition of the methods used by Consolidated Edison to classify possible non-utility power sources and of the factors of judgment used to determine their usefulness. Discussion of the three talks, under the capable guidance of R. G. Ely, Public Service Electric & Gas, chairman of the club, brought out many points of detail.

"Dimming Out Windows

An unprogrammed feature of the meeting was the description by J. S. Voorhees of a method for permitting high-intensity lighting of show windows during dim-outs. The method was developed by Consolidated Edison from the old stage trick of "scrim sets," by which the audience sees a brilliantly lighted second scene through what previously appeared to be an opaque back drop. A curtain of special fabric hung back of the glass allows the interior of the window to be seen clearly, but reduces very greatly the spill of light to the outside. Pictures of a Consolidated Edison show window so treated appeared in ELECTRICAL WORLD, June 6.

Output Shows Pick-Up for First June Week

As usual in the first week of June, figures on the amount of electrical energy distributed by the power industry took an upward trend again. According to the Edison Electric Institute, figures for the week ending June 6 showed 3,372,374,000 kw.-hr., which was an increase of close to 50 million kw.-hr. over the previous week. Last year's increase was more than double the present years, the week in 1941 showing a gain of 122 million kw.-hr.

The June 6 week showed a gain of 9.6 percent over the corresponding week of the previous year, but the gain was lower than the 12.5, 11.2, 11.5 and 11.6 gains marked up in the four previous weeks. Sharpest drop in percentage for the seven geographic regions was registered in the New England states, which showed a 7.4 percent gain for the latest week as compared to a 14.6 percent gain for the week ending May 30 over last year's figures.

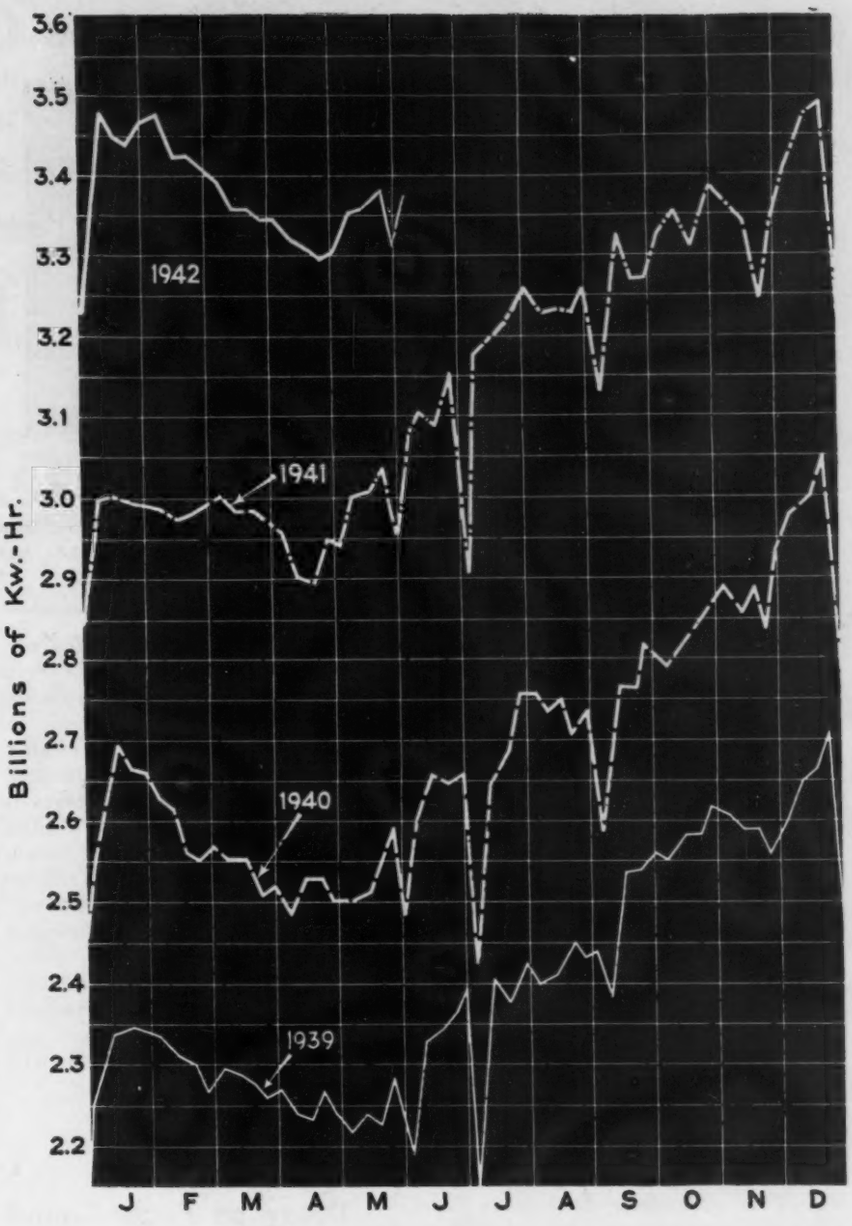
Weekly Output, Millions Kw.-Hr.

1942		1941		1940	
June 6	3,372	June 7	3,076	June 8	2,599
May 30	3,323	May 31	2,955	June 1	2,478
May 23	3,379	May 24	3,040	May 25	2,588
May 16	3,357	May 17	3,011	May 18	2,560
May 9	3,365	May 10	3,003	May 11	2,515
May 2	3,304	May 3	2,944	May 4	2,503
Apr. 25	3,273*	Apr. 26	2,950	Apr. 27	2,499
Apr. 18	3,308	Apr. 19	2,897	Apr. 20	2,529
Apr. 11	3,321	Apr. 12	2,906	Apr. 13	2,530
Apr. 4	3,349	Apr. 5	2,960	Apr. 6	2,494

Percent Change from Previous Year

	Week Ending		
	June 6	May 30	May 23
New England	+ 7.4	+14.6	+ 9.0
Mid-Atlantic	+ 5.8	+ 9.2	+ 8.2
Central Industrial	+ 7.3	+12.6	+ 9.0
West Central	+10.4	+10.4	+ 8.2
Southern States	+14.2	+10.7	+15.4
Rocky Mountain	+ 1.3	+ 7.0	+ 4.6
Pacific Coast	+17.6	+22.1	+19.2
Total United States..	+ 9.6	+12.5	+11.2

*Revised figure.



Northern States Files to Liquidate

Northern States Power Co., a Delaware corporation, last week submitted a plan for liquidation to the SEC that would cut it off from sixteen operating companies doing business in Minnesota and Wisconsin.

Under the plan the 60,000 stockholders of the Delaware company would become shareholders in a subsidiary, the Northern States Power Co. of Minnesota, thus holding an interest in a direct operating utility rather than a holding company. The Delaware company is capitalized at $86,000,000 and the Minnesota company at $117,000,000. Both are units of Standard Power & Light corporation system.

Company officials said that operation of the plan would result in the elimination of approximately $337,000 annually in expenses now paid to the Delaware company.

The Delaware company owns the 4,000,000 outstanding common shares of the Minnesota company. The Delaware company would surrender 481,000 of the shares to the Minnesota company which, upon authorization from SEC and its stockholders, would reclassify the remaining shares into 8,354,278 shares of $10 par value.

The reclassified Minnesota stock would be distributed to Delaware stockholders as follows: Ten shares for each share of Delaware, 7 percent cumulative-preferred stock, 9.1 shares for each share of Delaware 6 percent cumulative preferred, 1.95 shares for each share of Delaware class A common stock and 0.1625 share for each share of Delaware Class B common.

The Minnesota stock would be divided 90.50 percent to preferred Delaware holders, 8.07 percent to class A common holders and 1.43 percent to class B common holders. Script certificates would be issued for fractional common shares.

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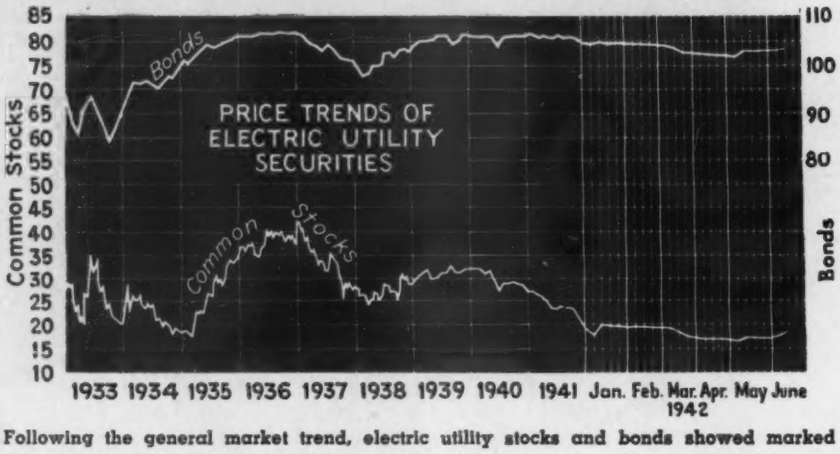
Three N. Y. Coops Formed

Following the creation of rural electric non-profit membership corporations in New York state (ELECTRICAL WORLD, May 9, page 10) three associations have filed to become cooperatives which were originally chartered under the transportation corporation law. The associations are the Genesee Valley Electric Cooperative, Belmont, N. Y.; the Otsego Electric Cooperative, Inc., Hartwick, N. Y., and the Steuben Rural Electric Cooperative, Inc., Bath, N. Y.

Utility Securities Continue Upward Trend


PRICE TRENDS OF
ELECTRIC UTILITY
SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1933 1934 1935 1936 1937 1938 1939 1940 1941 Jan. Feb. Mar. Apr. May June 1942

Following the general market trend, electric utility stocks and bonds showed marked improvement the past week. "Electrical World" stock index advanced to 18.7 from 18.0 the previous week; last year, 23.6. Bonds went to 102.8 from 102.5; last year, 105.8

SEC Denies United Corp. Wartime Delay

Another effort by a public utility holding company to stay dissolution proceedings under the "death sentence" provisions of the holding company act met with defeat last week when the SEC denied motions of the United Corporation to postpone action on compliance with Section 11 (b) 1, (b) 2 and (e) until after the war.

"The record to date indicates," SEC said in its opinion, "that the United Corp. can lay no claim whatsoever to any participation in or relevance to the war effort."

The commission's opinion quoted a similar action on a motion by Commonwealth & Southern Corp. to suspend proceedings for the duration and followed, in addition, a decision of the same kind where the Middle West Corp. and two subsidiary holding companies were denied pleas for delay. "United has advanced no reason," the SEC said, "and we see none, to persuade us to depart from these conclusions.

"Without prejudging the ultimate issues in this case, but examining the record as it stands at this point . . . it appears from the evidence already adduced that United is at the apex of an extended pyramid, exposed to wide fluctuations in its income. It is a superholding company imposed over other holding company systems. United . . . is so far removed from the base of the pyramid, the operating companies, that its personnel appear to have little or nothing to do with the production and distribution of power to consumers."

It was noteworthy also, the SEC opinion pointed out, that representatives of a number of Philadelphia banks and insurance companies, representing a total of 149,468 shares of United preferred stock, had appeared at the hearing and opposed the suspension motion of the utility. They had further testified that (1) the existing distribution of voting power in United was inequitable, (2) that action should be taken to reduce United capitalization to a single class of stock. Said SEC: "We concur in the judgment of this large and responsible group of investors in United."

In its order SEC also denied a United motion objecting to 391 exhibits introduced by the commission's public utilities division, dealing with financial data on the system. Denial of both motions of the United upheld the trial examiner's findings.

•

Utility Asks Year Delay on Puget Sound

Engineers Public Service Co. and subsidiaries petitioned the SEC last week for a delay of an additional year, from July 23, to comply with an order issued last July 23, requiring the company to dispose of its ownership and control of the Puget Sound Power & Light Co. and the Key West Electric Co. Under the act the company has a right to seek a second year.

SEC directed that hearing be held on June 22 to determine whether Engineers Public Service had "exercised due diligence" in the past year to comply with the order.

Utility Reports

	Net Income 1942	1941
*Alabama Power	$3,275,480	$3,134,185
*Central Illinois Light	1,583,150	1,572,333
*Central Maine Power	1,963,628	2,188,336
*Consumers Power	8,930,612	10,316,308
†Duquesne Light	9,967,225	9,807,638
*Georgia Power	5,390,519	4,702,419
*Gulf Power	338,277	308,370
*Iowa Elec. Light & Power	723,561	775,290
*Mississippi Power & Light	538,586	300,962
†National Power & Light and subs.	5,850,772	9,036,690
*Northern Indiana Public Service	2,508,990	2,845,617
*Northwestern Electric	525,810	490,443
*Ohio Edison	3,717,927	3,884,181
†Portland General Electric	1,477,760	1,330,783
*So. Carolina Power	470,030	395,525
†Standard Gas & Electric and subs.	3,244,194	3,309,540
*Texas Electric Service	1,056,237	1,240,706

*Twelve months ended April 30.
†Twelve months ended March 31.

Jersey Utility Subject to FPC

Jersey Central Power & Light Co. is subject to supervision and regulation by the Federal Power Commission, according to a unanimous decision of the U. S. Circuit Court of Appeals made recently.

The court's decision upheld a 1939 order of the commission that New Jersey Power & Light disclose all the facts in connection with its acquisition of 341,350 shares of the common stock of the Jersey Central Power & Light Co. in March, 1938. The stated value of the shares was $4,312,308 and the two companies had challenged the authority of the commission to look into the transaction on the grounds that their business was primarily within the state of New Jersey. The court held, however, that Jersey Central is a public utility within the meaning of the Federal Power Act because some of the energy generated at its South Amboy plant goes to the Staten Island Edison Co.

•

FPC Issues "Show Cause" Order on Hydro Project

Federal Power Commission has ordered the Western Massachusetts Electric Co., Turners Falls Power & Electric Co., United Electric Light Co. and Pittsfield Electric Co. to supplement a pending application for approval of the merger and consolidation of the facilities of the four companies by showing cause why the Turners Falls and Western Massachusetts companies should not be required, as a condition of authorization, to apply for a license under provisions of the Federal Power Act for the Turners Falls hydro-electric development on the Connecticut River.

The companies are also ordered to show cause why three transmission lines connected with the project should not be held to be a part of the project within the meaning of the Federal Power Act, and to submit certain information pertaining to four other lines leading from the project for the commission's use in determining their status with respect to licensing.

This advertisement appeared in:
NEW YORK TIMES
CLEVELAND PLAIN DEALER
DETROIT FREE PRESS
CHICAGO TRIBUNE
WASHINGTON POST
PHILADELPHIA BULLETIN
NEW YORK HERALD-TRIBUNE

Today's Sweat is Tomorrow's Victory

Behind the news of today's battles, the most amazing chapter in the whole history of mankind is taking shape.

When the chapter is ended, these battles will have become skirmishes on the road to victory . . . and men of business, labor and Washington will have licked the inventors of mechanized warfare at their own game.

The first paragraphs in the war news of the future are beginning to appear, in the production reports of America's brand-new war industries.

Tanks, planes, guns, bombs are pouring from factories that were making locomotives, autos, ladies' handbags until Pearl Harbor Sunday.

One of the most dramatic stories in the history of our times will be the production record of a cross-bred vehicle of destruction.

Half locomotive, half automobile, this cross-breed is the world's toughest, most agile and viciously efficient tank.

But the historical potency of the newly born American tank lies not so much in its ability to take and dish out punishment, as in the amazing fertility of the production lines from which it springs.

As we contemplate the industrial miracle of this rapid union of two different manufacturing methods, there are important lessons to be drawn:

▶ Compressed within the short space of a few months, we have seen a gigantic and vivid demonstration of the interdependence of industry.

This aspect of industry is not so apparent in peacetime.

OVER ▶

War gives business executives, and governmental officials, an added opportunity to study these relationships in sharp relief.

American industry is not like that of any other nation. It is more highly specialized. Therefore it is more sensitive to the technical disruptions of war production, as well as to economic and social stresses.

Another fundamental difference between American industry and other industrial systems has been highlighted by war:

Because our industry is specialized, its system of inter-industry communication has been developed to a higher degree than in any other country. Publishers call this system the "Industrial Press;" you used to think of it as the "trade papers."

▶ Industrial magazines knit together the specialized industries which comprise the total of America's marvelous productive capacity. They give men who specialize on a particular industrial function the assurance that, when they need to know about a machine, material or technique developed in another industry, complete information will be readily available.

Most people know this peace-time function of the industrial magazine. Few people know the dramatic story of how this typically American system has worked in the frantic interchange of techniques involved in war-conversion.

War-conversion, in America, means a complete disruption of specialized production routines.

In applying automotive production methods to heavy industry as represented by the tank, the interchange of information was complex and urgent.

How was it done?

Of course there was a great deal of travel between plants. Of course men plead with Washington for help. Of course there was trial and error. But if only these things had happened, we would still be building tanks in the continental manner.

Too many men, in too many plants, had too many questions for them to be solved by individual effort.

▶ Results were made the common knowledge of all, through the industrial editor. If industry "A" had solved a problem, industries "B" to "Z" found out about it in industrial magazine articles and advertisements . . . it has been the system for 50 years. It becomes more dramatic in wartime.

Few people realize that the difference between making 1 tank a month and making 1 tank every 12 minutes rests more on solving hundreds of little problems than it does on big decisions.

Men who have drilled holes in softer metals meet new problems when they have to drill those holes through armor plate at production line speeds.

When they must cast silicon bronze, men who have been making iron or brass castings turn to the industrial editor and the industrial advertiser for help.

▶ Using cutting tools on alloy steels, when past experience has been on cast engine blocks, raises a whole train of problems involving cutting speeds, coolants, handling techniques, etc.

The training of millions of new workers was a problem needing quick solution for many a plant manager, foreman and workman.

These, and thousands of other problems, questions and answers have flowed through industry's system of communication, the Industrial Press.

The result has been a vital saving of time . . .

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W. P. B. . . . this advertisement is published by the McGraw-Hill Network of Industrial Communication.

• • •

THE McGRAW-HILL NETWORK

More than 1,000,000 of the executives, designers and production men, who give America her world supremacy in technical "know-how," use the editorial and advertising content of these 23 publications as a means of exchanging ideas.

American Machinist • Aviation • Bus Transportation • Business Week Chemical & Metallurgical Engineering • Coal Age • Construction Methods Electrical Contracting • Electrical Merchandising • Electrical West Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets • Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Transit Journal • Wholesaler's Salesman

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Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL
PUBLISHING COMPANY, INC.
330 WEST 42nd STREET • NEW YORK

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Transformer Uses Two Load Ratio Adjusters

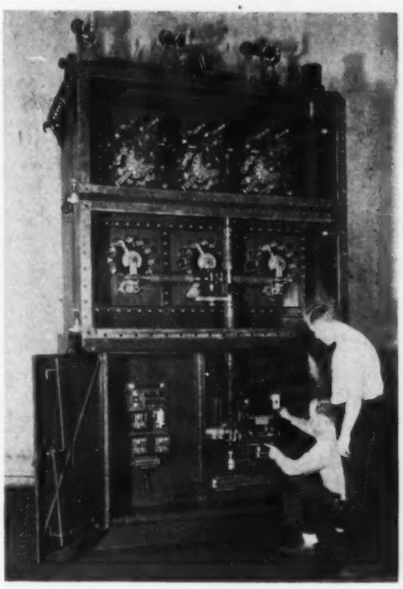
By E. F. CHRISTENSEN
Power Transformer Department,
General Electric Company, Pittsfield, Mass.

A 2,800-kva. regulating auto-transformer built for the University of California cyclotron is the first application using a combination of two load ratio control mechanisms to get a large number of comparatively small voltage steps.

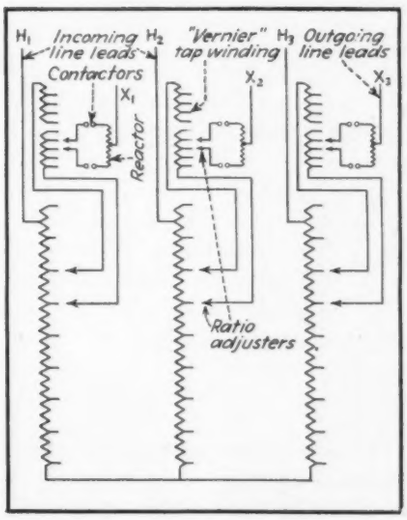
Referring to the illustration, the ratio adjuster in the upper compartment is connected to nine equally spaced taps on a "vernier" winding on the regulating transformer. The ratio adjuster in the middle compartment is connected to nine taps equally spaced across the whole winding of the auto-transformer.

The two adjusters are connected together mechanically through a 9:1 gear ratio and are driven by a single motor drive located in the lower compartment. With this arrangement the "vernier" ratio adjuster gives nine voltage positions for each tap step of the "coarse" ratio adjusters, resulting in 73 tap positions for the complete voltage range. No current is broken by the ratio adjusters; all arcing is confined to the contactors above the adjusters in the upper compartment. Remote manual push-button control will be used for selecting tap voltage positions. Connections of the auto-transformers and ratio adjusters are shown.

The circuit consists of the 2,800-kva. regulating auto-transformer which takes power from a 12,000-volt, three-phase, 60-cycle supply, and by means of the 73-position load ratio control mechanism furnishes an output voltage, adjustable from zero to 12,600 volts, to a three-phase wye connected monocyclic network. One leg of this network is a 1,615-kva. capacitor bank, another leg a 992-kva. reactor and the third leg is the primary of a 2,855-kva. single-phase full-wave rectifier transformer. The combined equipment supplies pulsating direct current at potentials up to 25,000 volts crest to the plates of the high-frequency tubes of the cyclotron.



COMPARTMENTS (opened) of oil-immersed regulating auto-transformer for cyclotron



SCHEMATIC connections of auto-transformer and ratio adjusters

The purpose of the monocyclic network is to change constant-potential, three-phase power to constant-current, single-phase power. In addition, it protects the equipment by preventing an increase in current if a short circuit should occur within the cyclotron.

Construction of the rectifier transformer is along the lines of a standard power transformer except that an electrostatic shield is built into the transformer between the primary and secondary windings. This shield is to prevent high-frequency surges from the cyclotron oscillator being reflected into the power system.

•

Meter Readers Effect Savings, Make Tests

By K. M. NORCROSS
Distribution Superintendent
Sherrard Power System, Orion, Ill.

Time-saving methods for meter reading and testing have been practiced by the Sherrard Power System for about 20 years and found successful. These include the following elements:

Rural meters are read every three months. This saves gasoline, truck and labor expense. As farmers are not likely to move but once a year,

and then only a small percentage, little difficulty is experienced with their credit.

The meter reader calls at the farm home, reads the meter, computes the bill, presents it to the customer and collects the amount due. An average of 75 percent of the customers pay when the bill is presented. Thus on the meter reader's one stop the farmer clears his account for another three months. The bill is mailed to the customer if he is not at home to receive it.

The foregoing method has saved the need of a billing machine, a person to operate it and at least two stamps per customer, one to mail the bill and another to return the receipted bill.

Close Personal Contact

It has been found that the rural customer prefers to pay his bill immediately, without the expense of going to town. He can also satisfy himself as to the correctness of the reading and billing in the presence of the meter reader and can file any complaint he desires at the time. Thus a close personal contact is created between the company and customer.

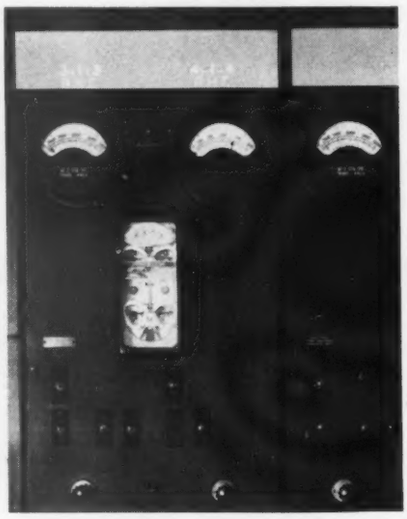
While passing along the rural lines, it is also the employee's duty to make notes of any unusual conditions, such as bad insulators, broken poles, etc. At the end of the day the notes are turned in to the distribution department for it to remedy the condition.

A meter reader in the territory served by this company can average 60 to 80 calls per day, which includes reading, billing and collecting. The cost per meter is thus quite low. This type of work requires an individual having integrity, industry, ability to get along with the public and ambition to gain promotion. By his knowledge of line locations and customers he will eventually develop into a good troubleshooter if he elects that type of work.

Having completed his meter route, the employee is then free to do other work. Consequently, the meter readers are trained to test meters. If one or two complaints have been received while reading meters, he returns with his test kit to the farm to make a test on the meter and dispose of the complaint personally, thus further promoting close customer contact. The rest of his time he spends making periodic tests.

Identification Tags Made of Plastic—II

By **BENJAMIN LEVY**
Public Service Electric & Gas Company,
Irvington, N. J.



ANNUNCIATOR PANEL at top of control board makes use of plastic material

Rear illumination brings out amber designation in white-faced, black-backed translucent material. Utility-engraved plastic tags identify switches, meters and controls; these are three-layer, white-cored, black-faced and backed.

A recent article (ELECTRICAL WORLD, May 16, 1942) told of the plastic identification tags engraved by Public Service Electric & Gas Company of New Jersey. A "danger" sign recently adopted by this utility differs somewhat from the other plastic signs. Instead of a red tag with the word "danger" routed through to the white core, this sign is purchased ready-made. It, too, is of laminated plastic, with the printed "danger" on paper just underlying the transparent Bakelite cover. Cost of this sign is under that of the more conventional engraved plastic sign. This new type is also more durable than an enameled metal sign.

Still another variation is used for annunciator signs. Metal stampings in back of opal glass illuminated from behind were first used. Then, Bakelite was substituted for the metal. In the third form, translucent plastic material is used and the opal glass has been eliminated. This material has three layers—black, amber and white—with the letters cut through the black, so that the designation—phase number, etc.—will appear in amber when the sign is illuminated from behind. Amber has proved most visible under operating conditions.

"Vinylite," a product of the Carbide & Chemical Corporation, is used for the annunciator panels.

ED. NOTE—This is the second of two articles on plastic identification tags and panels used by Public Service Electric & Gas Company.

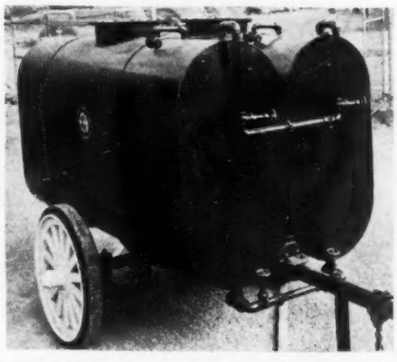
• • •

Portable Oil Tank Made From Old Parts

By **H. G. WILLIAMS**
Superintendent of Operations
Electric Power Board of Chattanooga

A portable oil tank was made in our shop from two old 120-kv. electrolytic lightning arrester tanks which were mounted on an old pole trailer. The capacity of the two tanks is 1,100 gal., or 550 gal. each. This unit provides a very convenient method of handling the oil during switch inspection, or in case oil treatment is necessary in either oil circuit breakers or transformers which are located at stations where no oil storage facilities are provided.

Manholes were provided for cleaning and the piping is so arranged that the oil can be circulated from one tank to the other through the oil-purifying outfit, which permits thorough reconditioning of the oil before refilling the piece of equipment from which the oil was removed. When in use this tank is attached to the 1½-ton truck on which our oil purifying outfit is mounted.



PORTABLE oil tank constructed from discarded equipment

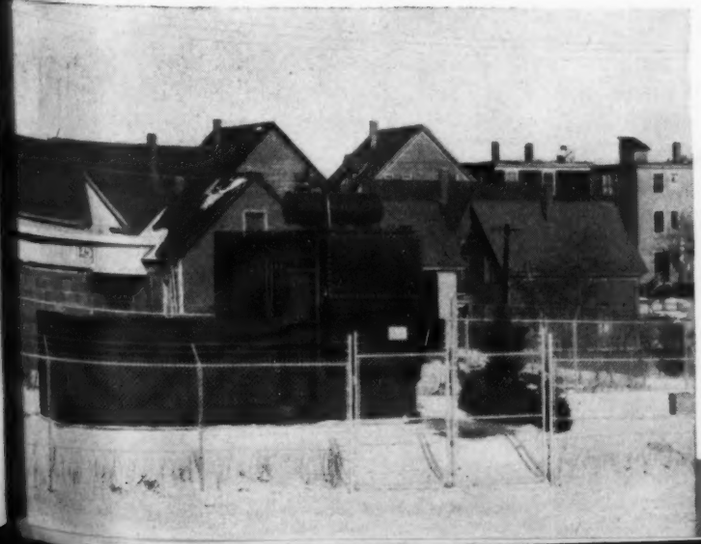
Expand with UNIT SUBSTATIONS

Slide the factory-assembled sections into position, make the necessary connections, and your unit substation is ready for service.

Your best bet for supplying fast-growing loads

SAVE
Time, Space, Material

Their neat, attractive appearance makes G-E unit substations readily acceptable even in residential areas.



PROPERLY co-ordinated, factory-built unit substations—one solution of your vital problem of supplying today's rapidly growing loads. They're easily and quickly installed—in days rather than weeks—with a considerable saving in important materials. ***They're easily moved when load centers change;*** you'll never have large blocks of capital tied up in idle substation equipment that you provided for future growth. Engineering and planning time are sharply reduced; you purchase the substation as a "package," from a single manufacturer, with a simple functional specification.

Compactly designed for outdoor service, unit substations make large investments in real estate and buildings unnecessary. And you can locate them ***close to load centers*** so secondary feeders are shorter (saving tons of vital copper), losses are lower, service better.

Add up these advantages. We think you'll agree: for the changing power requirements of today ***and*** tomorrow, unit substations offer the practical, far-sighted answer. Ask your local G-E representative for more information—or write direct for descriptive literature. *General Electric, Schenectady, N. Y.*

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

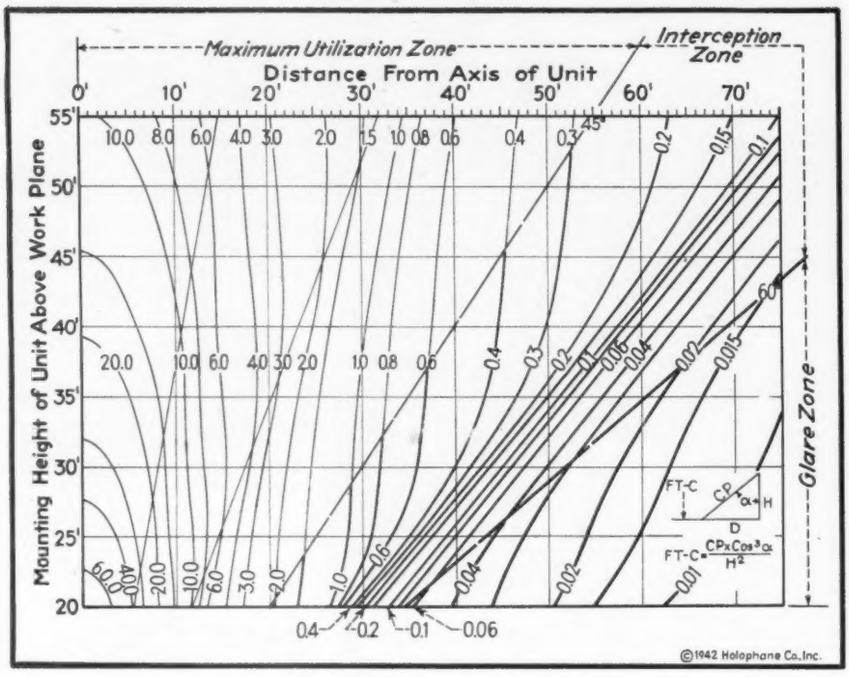
GENERAL ELECTRIC

302-5-5900

HOW TO FIND

Light Intensity at Any Point

By JOHN H. DEAN
Engineering Department, Holophane Company, Inc., New York, N. Y.


Maximum Utilization Zone
Interception Zone
Distance From Axis of Unit
0' 10' 20' 30' 40' 50' 60' 70'
Mounting Height of Unit Above Work Plane
55' 50' 45' 40' 35' 30' 25' 20'
Glare Zone
45°
60°
FT-C = CP / H²
FT-C = CP x Cos³α / H²
D
©1942 Holophane Co. Inc.

Instructions for Use of Chart

Plan of lighting system must be of same scale as chart—each horizontal scale division equals 1 ft. Find intersection of the "distance from axis of unit" scale with "mounting height above work plane." Place this point at luminaire location and hold in place, with finger or pin. Turn chart until horizontal line from this point intersects point on floor plan at which foot-candles are desired. Interpolate between curved foot-candle lines where they cross the horizontal line and read foot-candle value at this point. Continue operation for all units contributing to point and add the results. This particular chart worked out for 1,000-watt, 21,000-lumen bulb in prismatic glass high-bay reflector.

With this chart it is possible to determine the foot-candles of illumination at any given working plant point in a lighting installation of 1,000-watt, 21,000-lumen incandescent lamps in typical prismatic-glass, high-bay reflectors. Similar charts can be drawn for any size and kind of luminaire unit with symmetrical distribution of light.

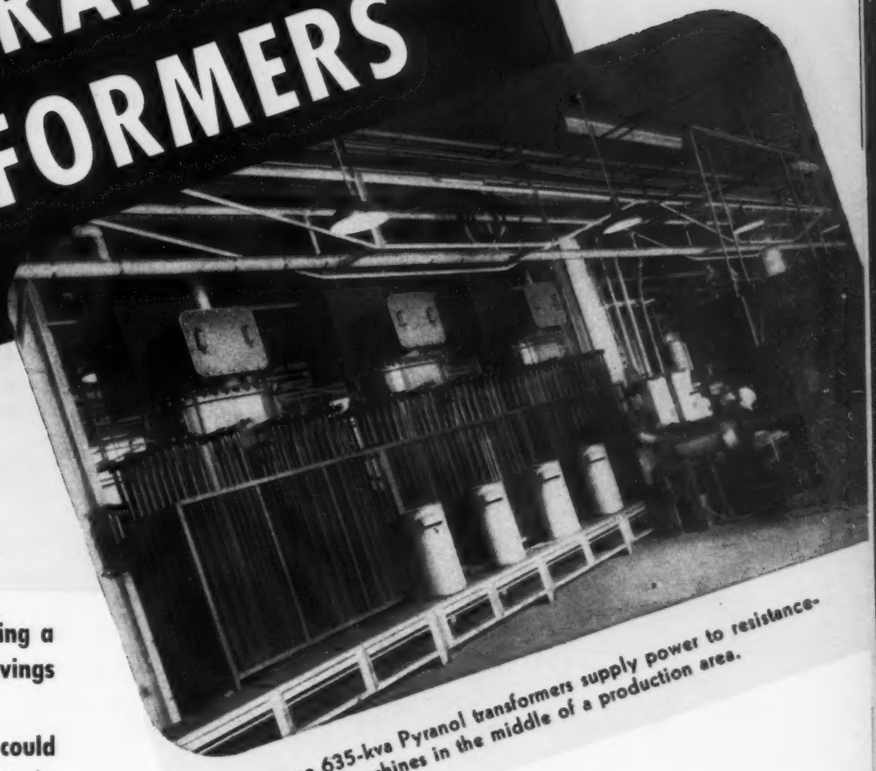
The light intensity at any point is the sum of the intensities from all of the luminaires that effectively illuminate the point. The intensity from each luminaire is read from the chart at the intersection of a line projected horizontally from the mounting height on the left-hand scale with a vertical line dropped from the top scale at the distance of the point from the axis of the lighting unit. By interpolation it is possible to read the intensities to two or three significant figures and thus to arrive at an accurate total.

It will be noted that the chart is divided into three sections. The left-hand section includes the light that falls on the working point within an angle of 45 deg. from the vertical; this section is called the "maximum utilization zone." The middle section includes light between 45 and 60 deg. from the vertical. Light in this "interception zone" is still useful, but is liable to interference or interception by equipment, structural members, the work, the worker's body, etc.

Under most practical conditions light in this zone will not contribute to the working point.

The third section, or "glare zone," is the area included by angles above 60 deg. Light in this area usually falls in the eyes of the workers, and although it contributes a small amount of light to the working point, it diminishes visibility because of the effect of the glare with a new loss in seeing effect. Consequently, under almost all conditions, light from the "glare zone" should not be added in the total.

TO THE HUNDREDS OF NEW USERS OF PYRANOL TRANSFORMERS



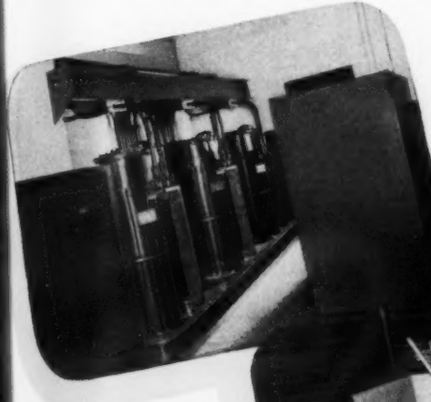
These 635-kva Pyranol transformers supply power to resistance-welding machines in the middle of a production area.

By installing Pyranol transformers (instead of making a conventional transformer installation) you made big savings in materials and over-all installed cost.

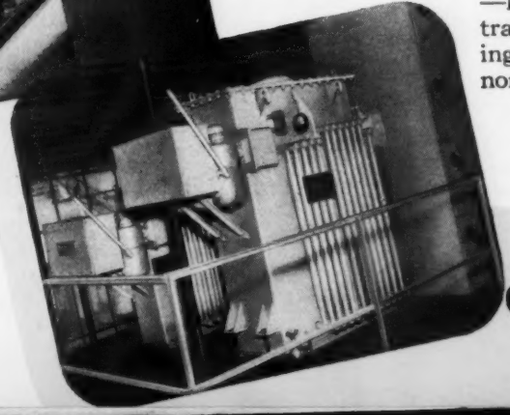
You reduced installation time and cost, because you could install these transformers indoors without a fireproof vault.

You saved copper—many tons of it if your plant is a large one—because you could install these transformers right at load centers, where transformers were meant to be installed.

You reduced line losses and voltage drop in your plant circuits and assured better performance from motors, resistance-heating equipment, lamps, and other electric equipment.



Vaultless installation of these 225-kva Pyranol transformers in a steel-mill motor room meant savings in materials plus economical power distribution.



These G-E load-center unit substations, incorporating Pyranol transformers, are part of a G-E load-center power-distribution system in an expanding war plant.

Safety of Pyranol—an Asset to Your Plant

Since the introduction of Pyranol in 1932, more than 4,000,000 kva of new transformers have been furnished with this type of noninflammable insulating and cooling liquid. No Pyranol transformer, in 10 years of operating experience, has burned or contributed to a fire.

Greater Reliability—a Continuing Benefit

The high dielectric strength of Pyranol means extra stamina to resist damage from voltage surges resulting from switching operations or lightning. This is a safeguard against progressive deterioration of the insulation that might otherwise result in a transformer breakdown and loss of power service.

Pyranol transformers have other features that mean greater reliability and little maintenance. The pressure-tight steel tank protects both liquid and solid insulation—keeps out dust, dirt, moisture, and other enemies of transformer life. Pyranol is nonoxidizing and nonsludging. It will retain its insulating properties over years of normal operation. *General Electric, Schenectady, N. Y.*

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

402-61-5100

New Test Set Aids Meter Research

By GEORGE J. WEY

Meter Design Engineer, Westinghouse Electric & Manufacturing Company, Newark, N. J.

Several interesting features are incorporated in a new stroboscopic test set, designed specifically to facilitate research and engineering studies in the course of development of watt-hour meters, and installed in the engineering department of the Westinghouse Electric & Manufacturing Company.

Loading and switching facilities have been provided to permit testing at 5, 10, 20, 50, 150, 200, 300 and 400 percent rated current loads and from 70 to 130 percent rated voltage in 10 percent steps. Meters of nominal 5, 15 or 50 amp. rating and 120, 240 or 480 volt rating can be tested.

The test set is supplied from a 120-volt, three-phase power source. A 50 percent power factor condition is obtainable by switching the potential circuits to the other phases. Frequency and ambient temperature influences are eliminated through comparison with the rotating standard, as is the customary practice. A 10-volt loading transformer is used to energize the current coils.

It will be noted that the rotating standard is mounted directly above the test meter. The optical system projects the light beam through the rotating standard and the test meter, and the effect is observed through the eye-piece directly in front of the operator (see illustration).

While this stroboscopic unit was designed specifically to fit the development of a meter manufacturer, and is not available for sale under present conditions, it is possible that operating companies may obtain some helpful ideas from it.

•

More Steam—How?

2. Treatment of Extensive Make-up*

By ALFRED IDDLES

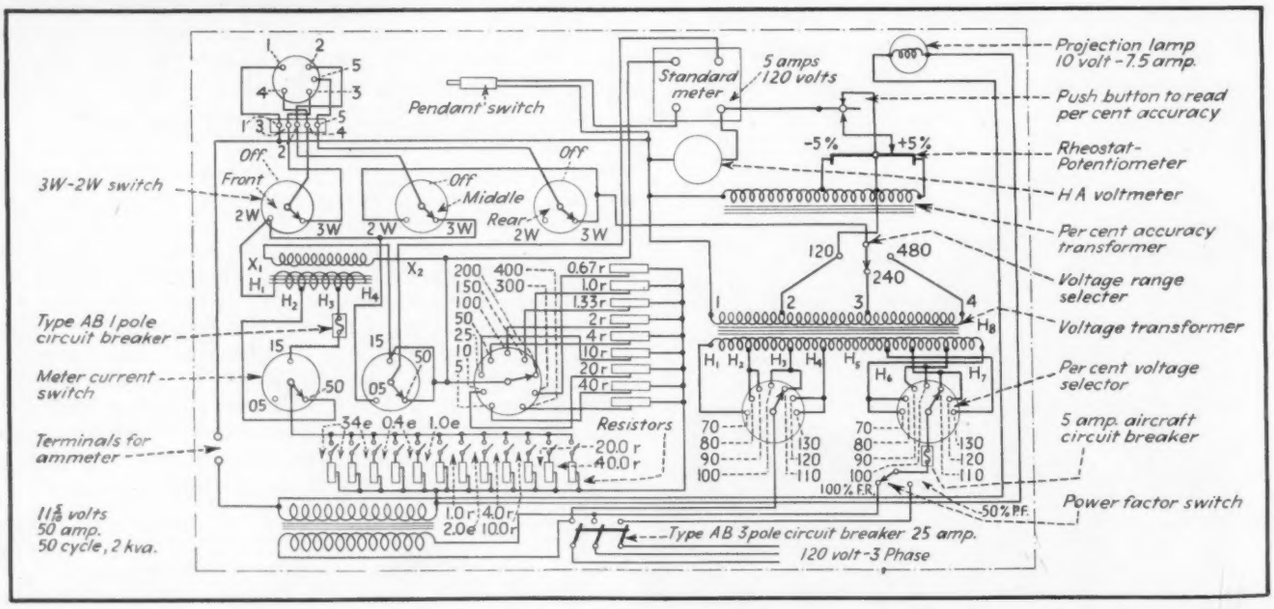
Application Engineer
Babcock & Wilcox Company

Where large quantities of raw water make-up are required the usual treatment for scale prevention is external to the boiler. This may be lime soda, hot or cold, with special additional treatment for precipitation of silica, or some variation of this basic treatment. Even with the best of raw water treatment a small amount of scale-forming material is put into the boiler, so that for a boiler with raw water and one with evaporator make-up it is necessary to add some treatment within the boiler.

In general, scale formation can be prevented by treatment with phosphate with or without other chemicals to adjust for boiler water condition. This treatment is likely to produce a sludge which may be troublesome. Either the quantity of this sludge must be kept at a low level or its physical condition must be so controlled that it will not stop in undesirable locations or bake out in tubes and form a semi-scale.

There are many 600-, several 800- and at least one 2,000-lb. boiler operating with treated raw water as the principal supply. Very great care is necessary to maintain accurate treatment or scale-forming material will get into the boiler and do its damage. Continuous blowdown is of course necessary to maintain the boiler water concentration within acceptable limits. Some operators meter this blowdown. At least one operator that I know runs a continuous check, consisting of a balance between input and output to the boiler. He calculates all chemicals introduced and balances these against chemicals removed either by blowdown or in steam and he has been able to operate two

*This series began in the May 16, 1942, issue of "Electrical World," adapted from author's talk "What the Operator Wants to Know" to Steam Power Division, A.S.M.E., Metropolitan Section, March 25, 1942.



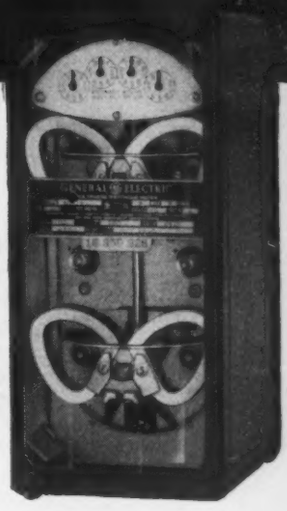
WATT-HOUR METER DEVELOPMENT is considerably expedited by this stroboscopic test set used in a manufacturer's laboratory

Tough Metering Problems?

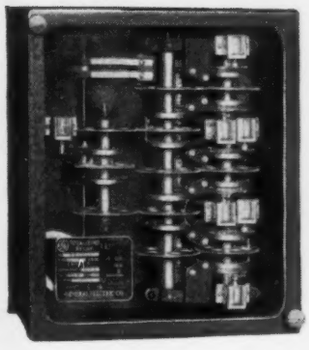
YOU TWO WAYS

2. Equipment

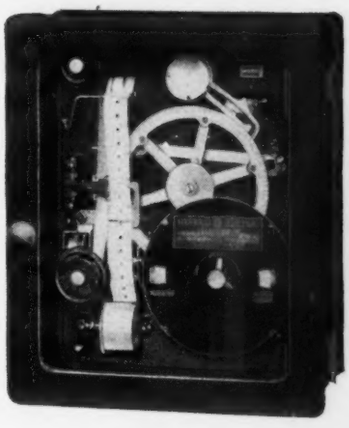
Power-pool metering—if each job is to be engineered correctly—calls for hundreds of varieties of equipment. And, that's what G.E. offers—a *complete* line to fill the bill. The variety is indicated here.



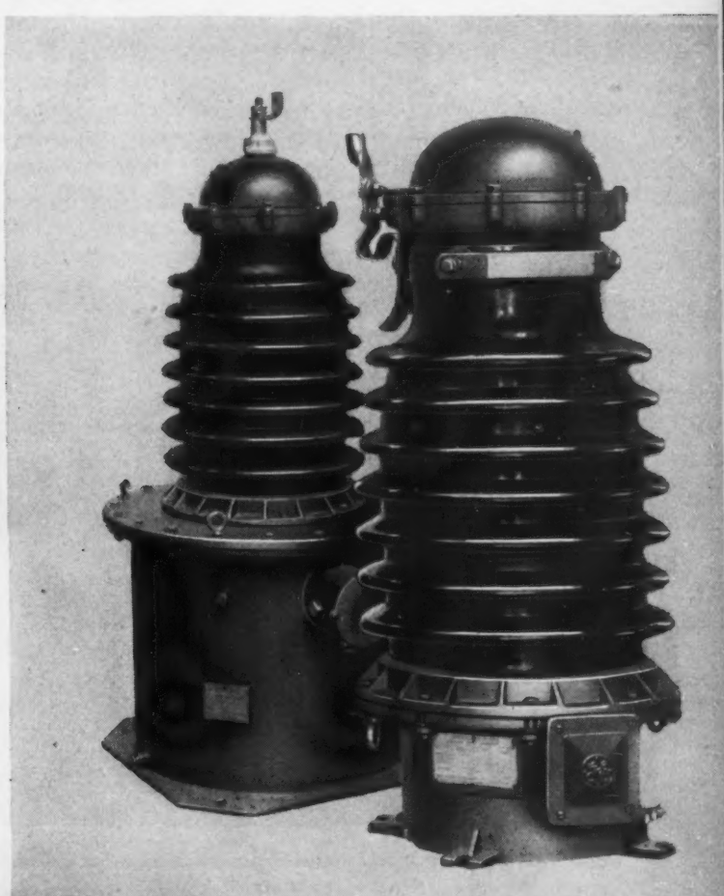
No matter what type of polyphase watthour meter you require—front- or back-connected, stationary or the newer drawout construction—you can find just what you need in the G-E line.



When you want to eliminate additional contact devices, to reduce servicing, and to improve the over-all accuracy of your metering, you want a G-E multiple-circuit relay. Any one of four different ratings are available—two-, four-, six-, or eight-circuit constructions. These relays have the inherent advantages and safety features of the three-wire principle of operation.



Where the value and importance of the demands dictate a high degree of accuracy, you'll want a printing demand meter. It is inherently more accurate than graphic or recording devices. Timing is by a separate, external, contact-making clock. If you prefer one that has a synchronous interval mechanism, you can get that too.



Whether you need a 5- or 3000-amp instrument transformer, 23-kv or 220-kv, Pyranol or oil-filled, you can select exactly what you want from the G-E line of porcelain-clad transformers. Compact, they conserve material, and save installation time and expense.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

605-4-6180

900-lb. boilers for almost five years without ever having scale formation or an outage due to tube trouble.

•

New Transformers Built of Old Parts

By C. B. HAWKINS
Superintendent of Transmission
Alabama Power Company, Birmingham

Due to its location with respect to electrical repair shops and factories and because of the scope of its operations Alabama Power Company has found it necessary to develop a well-equipped central repair shop capable of handling the repair and rebuilding of many types of electrical equipment. In the current defense effort these shop facilities are proving very advantageous, not only in repairing damaged equipment but in adapting obsolete equipment to current defense needs.

For example, four 7,500-kva. IOSC/10,000-kva. OIAB-66,630/26,590/12,060-volt, single-phase, 60-cycle inert gas-filled transformers, shown in illustration, recently completed and put in service at Sylacauga, Ala., utilizing parts salvaged from four 2,100-kva. OIWC-110,000/22,000/2,300-volt, 60-cycle, single-phase transformers removed some years ago from one of the older generating plants of the company. In this case complete new windings were designed and built.

Another example, four 2,000-kva. OISC/2,500-kva. OIAB-44/6.9/2.3-kv., 60-cycle, single-phase transformers were constructed from some old water-cooled transformers. In this case, while the windings were not changed materially, the radiators, fans and controls were added, modern accessories were supplied and bushings were rebuilt.

As a third example, three 4,500 OISC-110/44-kv., 60-cycle, single-phase inert gas-filled transformers were constructed from some very old water-cooled units. They are now in place at Tuscaloosa, Ala.

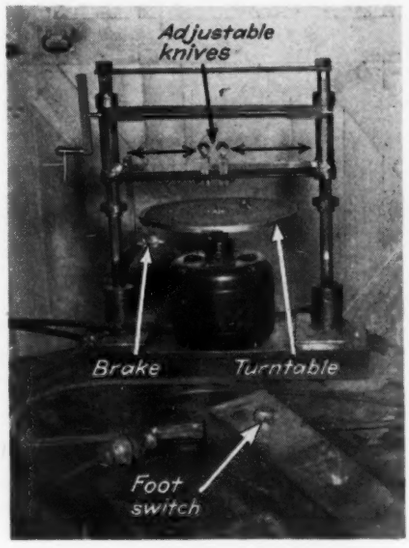
The North Birmingham shops have also rebuilt a large number of smaller transformers, particularly 50 kva. to 100 kva., which were changed from a rating of 44/2.3 kv. to 44/6.9 kv. Whenever transformers are rebuilt they are redesigned and equipped with modern accessories, so that on completion they compare favorably in every respect with modern, new equipment, even the factory tests being duplicated except for certain high potential and impulse tests. These shops have enabled the company to meet a number of emergencies incidental to rush defense requirements, and in addition, such transformer rebuilding operations usually result in very substantial savings as compared with purchase of new equipment.

The facilities for rebuilding high-tension bushings of all types are rather comprehensive and are kept busy repairing and modernizing the several thousand bushings—some of them quite old and rated 22 to 165 kv.—which are in service on the Alabama system. Facilities are provided for vacuum drying, impregnating with tung oil, and equipping with thermal seals, in addition to the ordinary facilities for the mechanical rebuilding processes. Some hundreds of bushings —110 kv. and above—have been rebuilt and modernized in the past few years at a saving running into tens of thousands of dollars.

SALVAGED PARTS of old transformers were used for building four new transformers shown in various stages of assembly

•

Gasket Cutter for Maintenance Shop



Cork gaskets of the many sizes used on electrical equipment are cut to order on an ingenious motored cutter built by maintenance employees of Oklahoma Gas & Electric Company. This machine has paid for itself in time saved, over hand cutting of gaskets, and in improved gasket fit.

Gasket blanks are fastened to a balanced turntable drive by a 1/10-hp., 1,800-r.p.m. clutch motor controlled by a foot switch made from an automobile starter switch. The turntable, formerly the base of a 69-kv. lighting arrester is fitted with a cork pad and a center screw for holding the gasket blank.

Motor and turntable are mounted on a steel channel base between uprights fitted with a rack which, with a crank-operated pinion, raises and lowers a frame carrying adjustable knives to cut the gasket. A brake is also provided to stop the turntable quickly when the gasket has been cut.

AN ELECTRICAL WHOLESALER HELPS SPEED WAR PRODUCTION

WESCO helped complete shipway 55 days faster

Located That 23rd Product—Kept Men at Work; Eliminated 41 "Red Tape" Operations.

A new shipway in Florida was under rush construction to buttress the "Bridge of Ships." Suddenly 23 priority items were needed to prevent work stoppage. The local WESCO House was called in; combed its stocks; had 22 products on the job in a few hours. The 23rd was a particular type of wire, unobtainable from any source. WESCO suggested an alternate type of wire—also not in stock. With approval of the Shipyard Construction Engineer, WESCO set out to locate a supply—found it—bought it—delivered it; all within 24 hours.

The 23 items delivered to the shipyard within one day tore nearly 2-months' delay off the calendar, maintained construction schedule and kept hundreds of men on the job. More than that, WESCO saved the customer 41 paper work operations required if he had dealt directly with usual sources of supply. WESCO's initiative and "know how" in the present emergency are exactly the same services WESCO has rendered its customers for 20 years. The only difference is—today they are labeled "For War;" tomorrow "For Business."

WESCO SPEEDS WAR PRODUCTION

* A manufacturer of cartridges received *immediate* delivery of transformers and miscellaneous electrical equipment. Without WESCO, this would have taken 90 days.
* Floodlights were needed for a bomber plant. When another source failed to deliver after a 15-day wait, WESCO made delivery that same day.

WESCO SERVES BUSINESS

* By offering prompt delivery of electrical items from large stocks.
* By knowing local codes and rulings.
* By providing engineering service in making up lists of materials and in preparing bids on jobs.

Westinghouse

ELECTRIC SUPPLY COMPANY

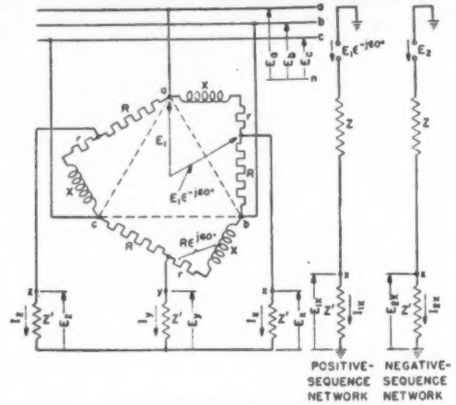
150 VARICK STREET • NEW YORK, N. Y.

The name that means everything in electricity

A NATIONAL DISTRIBUTING ORGANIZATION WITH 79 BRANCHES

How to Determine Relaying Quantities by Use of

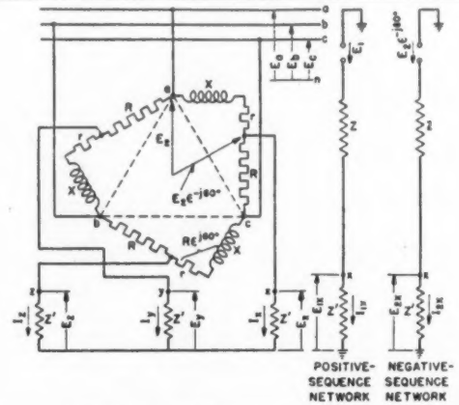
Extracted from advance pages of "Electrical Transmission and Distribution Ref



$$I_x = I_{1x} = \frac{E_1 \epsilon^{-j60°}}{Z+Z'}$$
$$I_y = I_{1y} = a^2 I_{1x}$$
$$I_z = I_{1z} = aI_{1x}$$
$$I_{2x} = 0$$
$$E_x = E_{1x} = \frac{Z}{Z+Z'} E_1 \epsilon^{-j60°}$$
$$E_y = E_{1y} = a^2 E_{1x}$$
$$E_z = E_{1z} = aE_{1x}$$
$$E_{2x} = 0$$
$$Z = \frac{R\epsilon^{j30°}}{\sqrt{3}}$$

If R is a pure resistance, then: $r = 0.5R$ and $X = 0.866R$.

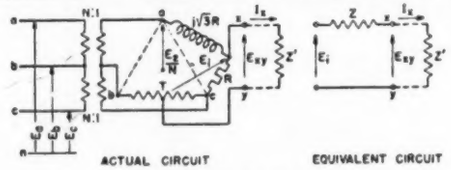
(a) Polyphase positive-sequence-voltage segregating filter



$$I_x = I_{2x} = \frac{E_2 \epsilon^{-j60°}}{Z+Z'}$$
$$I_y = I_{2y} = aI_{2x}$$
$$I_z = I_{2z} = a^2 I_{2x}$$
$$I_{1x} = 0$$
$$E_x = E_{2x} = \frac{ZE_2 \epsilon^{-j60°}}{Z+Z'}$$
$$E_y = E_{2y} = aE_{2x}$$
$$E_z = E_{2z} = a^2 E_{2x}$$
$$Z = \frac{R\epsilon^{j30°}}{\sqrt{3}}$$

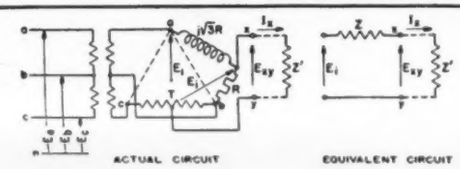
If R is pure resistance, then: $r = 0.5R$ and $X = 0.866R$.

(b) Polyphase negative-sequence-voltage segregating filter (Same as positive-sequence filter except for interchange of b and c leads)



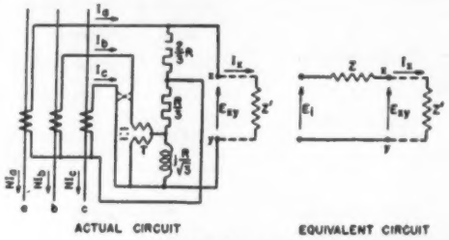
$$I_x = \frac{E_1}{N} \frac{1.5\epsilon^{-j60°}}{Z+Z'}$$
$$E_{xy} = I_x Z' = 1.5\epsilon^{-j60°} \frac{Z'}{Z+Z'} E_1$$
$$E_i = \frac{1.5\epsilon^{-j60°}}{N} E_1$$
$$Z^* = \frac{(3R+j\sqrt{3}R)}{4}$$

(c) Positive-sequence-voltage segregating filter



$$I_x = \frac{E_2}{N} \frac{1.5\epsilon^{-j60°}}{Z+Z'}$$
$$E_{xy} = I_x Z' = 1.5\epsilon^{-j60°} \frac{Z'}{Z+Z'} E_2$$
$$E_i = \frac{1.5\epsilon^{-j60°}}{N} E_2$$
$$Z^* = \frac{(3R+j\sqrt{3}R)}{4}$$

(d) Negative-sequence-voltage segregating filter



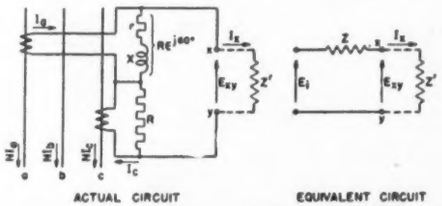
$$I_x = \frac{2R}{Z+Z'} I_1$$
$$E_{xy} = Z' I_x = \frac{2RZ'}{Z+Z'} I_1$$
$$E_i = 2RI_1$$
$$Z^* = R + jR/\sqrt{3}$$

(j) Positive-sequence-current segregating filter

Same as (j) except b and c leads crossed as shown dotted

$$I_x = \frac{2R}{Z+Z'} I_2$$
$$E_{xy} = Z' I_x = \frac{2RZ'}{Z+Z'} I_2$$
$$E_i = 2RI_2 \qquad Z^* = R + jR/\sqrt{3}$$

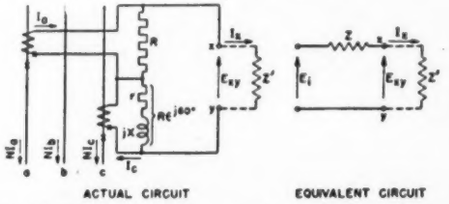
(k) Negative-sequence-current segregating filter



$$I_x = \frac{j\sqrt{3}R}{Z+Z'} I_1$$
$$E_{xy} = Z' I_x = \frac{j\sqrt{3}RZ'}{Z+Z'} I_1$$
$$E_i = j\sqrt{3}RI_1$$
$$Z^* = \sqrt{3}R\epsilon^{j30°} = 1.5R + j0.866R$$

When R is pure resistance, then $r = 0.5R$ and $X = 0.866R$

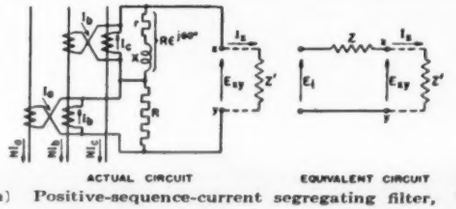
(l) Positive-sequence-current segregating filter. For use only where there is no zero sequence.



$$I_x = \frac{\sqrt{3}R\epsilon^{-j30°}}{Z+Z'} I_2$$
$$E_{xy} = Z' I_x = \frac{\sqrt{3}R\epsilon^{-j30°} Z'}{Z+Z'} I_2$$
$$E_i = \sqrt{3}R\epsilon^{-j30°} I_2$$
$$Z^* = \sqrt{3}R\epsilon^{-j30°} = 1.5R + j0.866R$$

If R is pure resistance, then $r = 0.5R$ and $x = 0.866R$

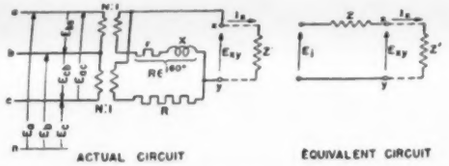
(m) Negative-sequence-current segregating filter. For use only where there is no zero sequence.



$$I_x = \frac{-3R}{Z+Z'} I_1$$
$$E_{xy} = Z' I_x = \frac{-3RZ'}{Z+Z'} I_1$$
$$E_i = -3RI_1$$
$$Z^* = \sqrt{3}R\epsilon^{j30°} = 1.5R + j0.866R$$

If R is pure resistance, then $r = 0.5R$ and $X = 0.866R$

(n) Positive-sequence-current segregating filter, With (or without) zero sequence.

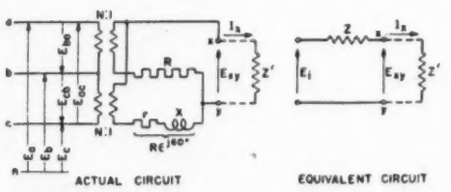


$$I_z = \frac{E_1}{N}\,\frac{\sqrt{3}\epsilon^{-j30°}}{Z+Z'}$$
$$E_{xy} = Z'I_z = \frac{\sqrt{3}\epsilon^{-j30°}Z'}{(Z+Z')N}E_1$$
$$E_i = \frac{\sqrt{3}\epsilon^{-j30°}}{N}E_1$$
$$Z^* = 0.5R + j0.289R$$

When R is pure resistance, then: $r = 0.5R$ and $X = 0.866R$

(Note: Requires Special Potential Transformer Connection)

(e) Positive-sequence-voltage segregating filter

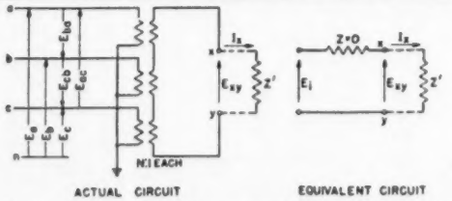


$$I_z = \frac{E_2}{N}\,\frac{\sqrt{3}\epsilon^{j30°}}{Z+Z'}$$
$$E_{xy} = Z'I_z = \frac{\sqrt{3}\epsilon^{j30°}Z'}{(Z+Z')N}E_2$$
$$E_i = \frac{\sqrt{3}\epsilon^{j30°}}{N}E_2$$
$$Z^* = 0.5R + j0.289R$$

When R is pure resistance, then: $r = 0.5R$ and $X = 0.866R$

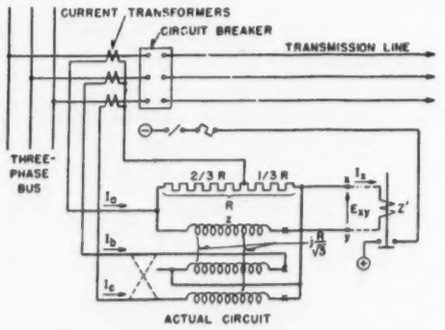
(Note: Requires Special Potential Transformer Connection)

(f) Negative-sequence-voltage segregating filter



$$I_z = \frac{E_0}{N}\,\frac{3}{Z'}$$
$$E_{xy} = Z'I_z = \frac{3}{N}E_0$$
$$E_i = \frac{3}{N}E_0$$
$$Z^* = 0$$

(g) Zero-sequence-voltage segregating filter (otherwise called star-series transformer connection)



$$I_z = \frac{2RI_1}{Z+Z'} \qquad E_i = 2RI_1$$
$$E_{xy} = \frac{2Z'R}{Z+Z'}I_1 \qquad Z = R+z$$

z = Self impedance of indicated winding of three-winding reactor as would be measured with other two windings open circuited.

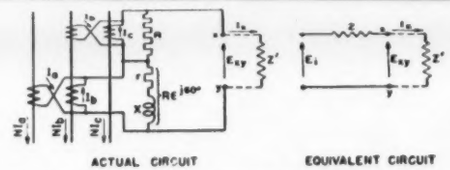
Note: A three-winding reactor is used having a mutual reactance $R/\sqrt{3}$ between each of the b and c phase windings and the metering circuit winding.

(h) Positive-sequence-current segregating filter and relay

Same as (h) except with b and c leads crossed as shown dotted

$$I_z = \frac{2RI_2}{R+z+Z} \qquad E_i = 2RI_2$$
$$F_{xy} = \frac{2ZRI_2}{R+z+Z}$$

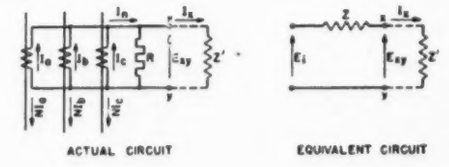
(i) Negative-sequence-current segregating filter and relay



$$I_z = \frac{3R\epsilon^{-j30°}}{Z+Z'}I_2$$
$$E_{xy} = Z'I_z = \frac{3R\epsilon^{-j30°}Z'}{Z+Z'}I_2$$
$$E_i = 3R\epsilon^{-j30°}I_2$$
$$Z^* = \sqrt{3}R\epsilon^{j30°}$$

If R is pure resistance, then: $r = 0.5R$ and $X = 0.866R$

(o) Negative-sequence-current segregating filter. For use when zero-sequence current is (or is not) present.



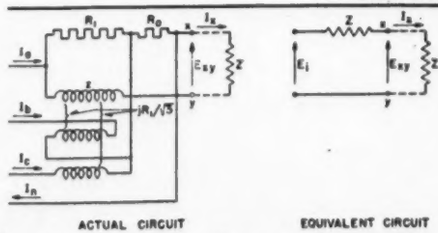
$$I_z = \frac{3R}{R+Z'}I_0$$
$$E_{xy} = I_zZ' = \frac{3RZ'}{R+Z'}I_0$$
$$E_i = 3I_0R \qquad Z^* = R$$

Note that if R is open circuited $I_z = 3I_0$ $\qquad E_{xy} = 3Z'I_0$

$$\left.\begin{matrix} E_i = \infty \\ Z = \infty \end{matrix}\right\}\frac{E_i}{Z} = 3I_0$$

Note: Residual or neutral current is three times the zero-sequence current. $(I_n = 3I_0)$

(p) Zero-sequence-current segregating filter (Neutral or star-connected current transformers)



$$I_z = \frac{2R_1I_1 + 3R_0I_0}{Z+Z'} = \frac{2R_1}{Z+Z'}(I_1 + kI_0)$$
$$k = \frac{3R_0}{2R_1} \qquad R_0 = \frac{2}{3}kR_1$$
$$E_{xy} = I_zZ' = \frac{2R_1Z'I_1 + 3R_0Z'I_0}{Z+Z'}$$
$$E_i = 2R_1I_1 + 3R_0I_0 = 2R_1(I_1 + kI_0)$$
$$Z^* = R_1 + R_0 + z$$

z = Self impedance of indicated winding of three-winding reactor.

(q) Combined positive-sequence-current and weighted zero-sequence-current segregating filter

General Equations and Nomenclature

$$E_1 = \frac{E_a + aE_b + a^2E_c}{3} \qquad I_1 = \frac{I_a + aI_b + a^2I_c}{3}$$
$$E_2 = \frac{E_a + a^2E_b + aE_c}{3} \qquad I_2 = \frac{I_a + a^2I_b + aI_c}{3}$$
$$E_0 = \frac{E_a + E_b + E_c}{3} \qquad I_0 = \frac{I_a + I_b + I_c}{3}$$
$$a = -0.5 + j0.866 \qquad a^2 = -0.5 - j0.866$$
$$I_z = \frac{E_i}{Z+Z'} \qquad E_{xy} = I_zZ' = E_i\frac{Z'}{Z+Z'}$$

**R, the reference impedance of the filter may be any vector value or a pure resistance. The other filter impedances must take corresponding values as indicated by their defining equations. They are resistances and reactances as indicated by the symbols on the diagrams only when the reference impedance, R, is pure resistance.

R^{**} = Reference impedance of filter.
Z = Impedance of equivalent circuit of filter.
Z' = Impedance of connected burden.
$\times$ = Polarity marks.
E_i = Internal voltage of equivalent circuit of filter.
I_z = Current in burden.
E_{xy} = Voltage at burden terminals, taking into account regulation in the filter. For maximum power output from a given filter make $Z' = \hat{Z}$. For maximum power output from a given filter feeding into a pure resistance burden $(Z' = R')$ make $R' = \hat{Z}$.
N = Current transformer or potential transformer ratio as indicated.

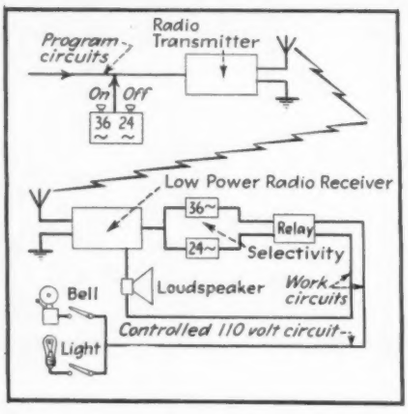
*More generally Z is the impedance measured on the terminals x, y with the burden Z' disconnected and the applied voltage Ea, Eb, Ec set equal to zero (or applied currents Ia, Ib, Ic made zero by open circuiting corresponding leads in the case of current filters). This includes in the proper manner the impedances of the potential or auxiliary current transformers. The values of Z given above are based on the use of ideal potential and auxiliary current transformers having zero leakage impedance and zero exciting current.

Use of Sequence-Segregating Filters or Networks

Reference Book," published by Westinghouse Electric & Manufacturing Co.

Low-Frequency Signals Operate Receiver

Utility, as well as civilian defense, uses are seen for new calling and controlling apparatus applicable to any radio communication system. Especially recommended for use with radio broadcasting stations, the new method utilizes sub-audible signals superimposed on the radio program circuit to actuate resonant tuned-reed relays at the receiver and turn on the loudspeaker, light a lamp or sound an alarm. A second low-frequency signal turns the receiver off.



NEW CALLING AND SIGNALING METHOD utilizes low-frequency signals When the 36-cycle note is imposed on the radio program circuit it is carried into the transmitter and onto the air. Picked up by the radio receiver at a distant location, the note is made to actuate the work circuits to turn on a light, ring a bell and turn on the loudspeaker. The 24-cycle note turns off the "alert" receiver through the same contacts. Commercial model of receiver is shown at top.

Signals are transmitted by means of a low-frequency signal generator consisting of amplifier circuits for obtaining harmonics of 60 cycles with an additional frequency-dividing circuit for obtaining sub-harmonics of these frequencies. Sub-audible frequencies, rather than super-audible frequencies, were selected because the higher frequencies would encroach on adjacent broadcast channels. In one form the transmitter sends 24- and 36-cycle signals.

The receiver may or may not incorporate a loudspeaker. In the type illustrated there is a self-contained loudspeaker, normally silent. When a 36-cycle signal is transmitted it actuates a tuned-reed relay in the receiver which has one set of contacts suitable for breaking a power circuit and turns on the working circuit; *i.e.*, the loudspeaker, any associated lights or alarms desired up to 3 amp. load. This relay is double-acting with mechanical locks, so that after the control signal has actuated the relay (within five seconds) no further application of the signal is required. Subsequent instructions can be given over the loudspeaker. Later transmission of the 24-cycle signal, to which the second reed is tuned, will turn the loudspeaker off.

The system provides the possibility of calling selectively each of a fairly large number of transmitting groups from one transmitting station. Each control function requires a selective reed and relay at the receiver unit and a control frequency at the transmitter. Each group has its own sub-audible frequency and approximately ten groups can be assigned between 20 and 40 cycles per second. Where more than one transmitter is available each can be used independently of the other, so that the number of groups individually callable is multiplied by the number of transmitters. While each transmitter is on a different wave frequency, each uses the same series of sub-audible frequencies to call its particular groups of receivers.

An important characteristic is that the sub-audible signals are not reproduced by the usual loudspeakers, so that ordinary receivers tuned to the station hear nothing of them. Therefore transmission of the signals does not interfere in any way with the normal service of the broadcast station.

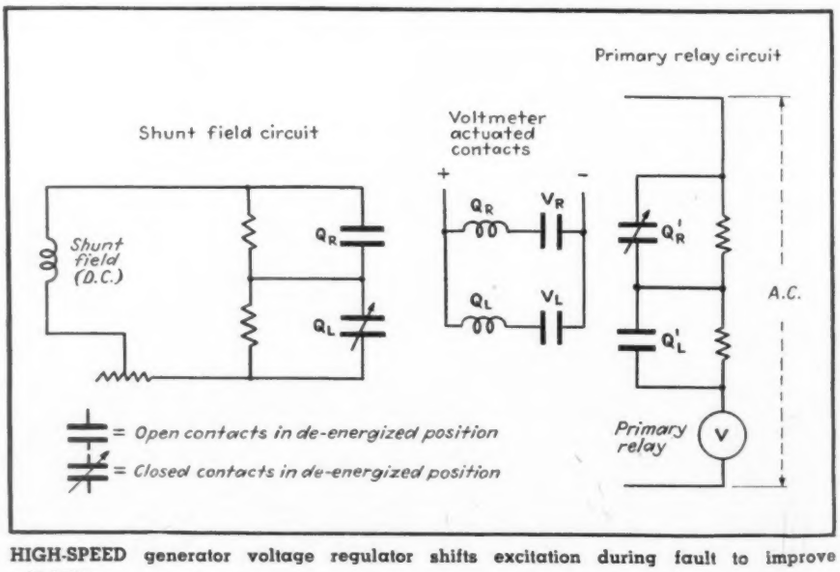
The new method is a development of RCA Laboratory engineers; the receiver is known as the "Alert" receiver.

•

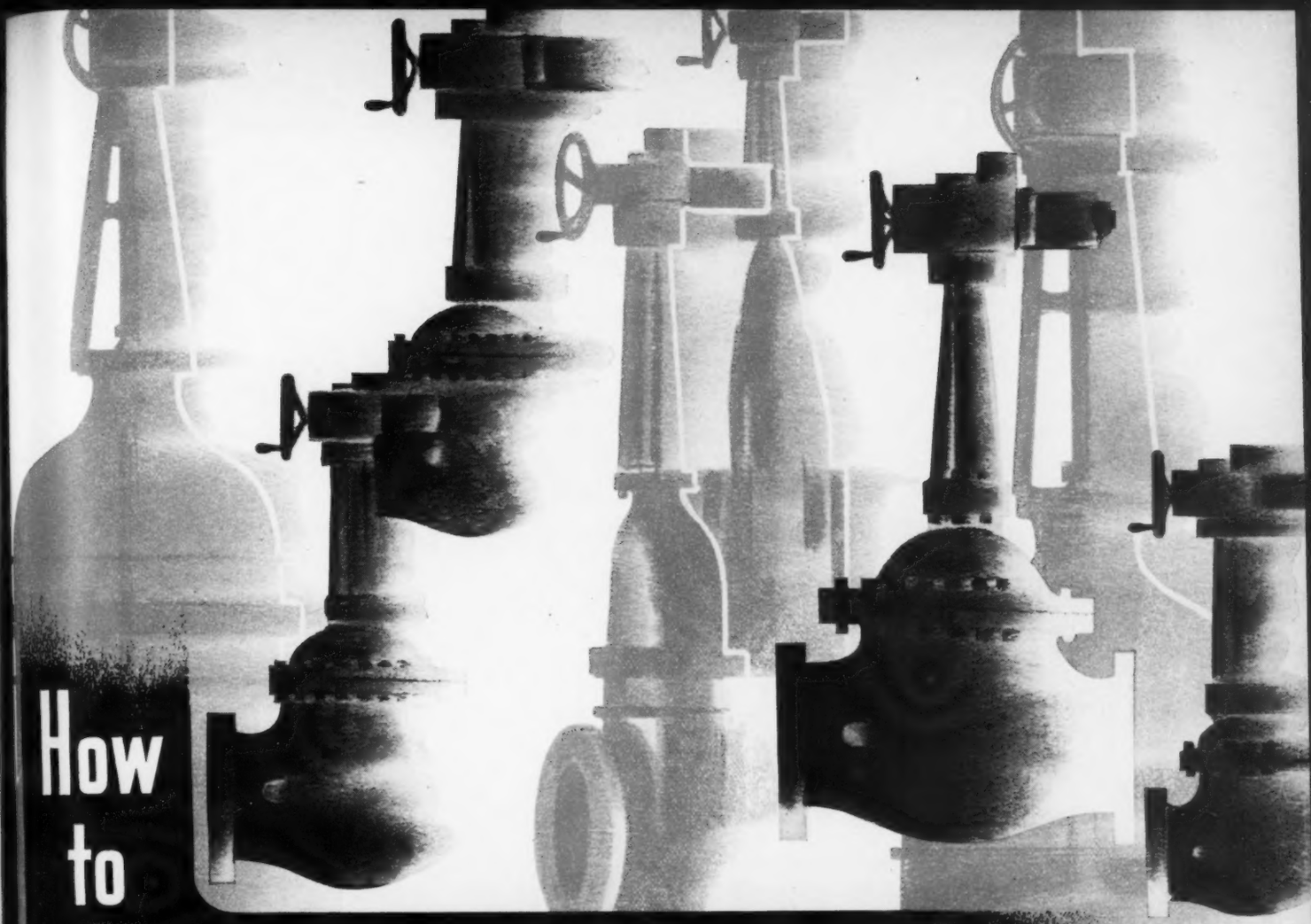
New High-Speed Generator Regulator

A recent contribution to the development of automatic stations is a high-speed generator voltage regulator consisting of two contactors, which quickly changes the excitation during faults to improve stability. As used by Wisconsin Public Service Corporation, it is not intended by itself to eliminate minor voltage variation; its purpose is to correct speedily the wider variations in voltage resulting from fault conditions and to supplement the conventional generator voltage regulator.

In operation, assume that the terminal voltage increases sufficiently to activate the high-speed mechanism. This causes the contact-making voltmeter in the primary relay circuit (see figure) to close contact V_L, permitting a flow of current through coil Q_L. Energizing this coil closes contact Q_L' in the relay circuit and



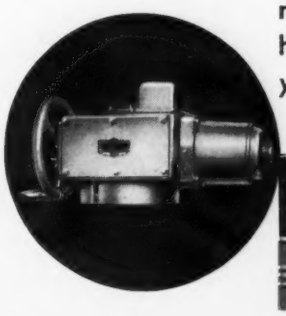
HIGH-SPEED generator voltage regulator shifts excitation during fault to improve reliability



How to Seat all valves Properly

SO *THEY WON'T BE DAMAGED BY TEMPERATURE CHANGES OR OBSTRUCTIONS*

To seat all valves properly so that they are tightly closed yet safe, simply insist on Cutler-Hammer Motor-Operated Thrust-Seating Valve Control. It seats valves on a proven "controlled-thrust-seating" principle. That means *accurate* seating under normal conditions, and *safety* under abnormal conditions. But most important of all, C-H Thrust-Seating Valve Operators automatically maintain the same degree of tightness as valve parts expand under *high* temperature and contract under *low* temperature. That's why with C-H Valve Operating Units you never get jammed valves, you never have to "back-off" valves . . . *and you won't be faced with shutdown at a time when continued, trouble-free operation is at the highest premium in history.* Insist on Cutler-Hammer Valve Control. For gas, water, high and low pressure steam service—in fact for any valve where fast, reliable operation and accurate seating can save you time, trouble and expense. It offers you every feature—plus. CUTLER-HAMMER, Inc., 1285 St. Paul Ave., Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.



CUTLER-HAMMER
VALVE CONTROL
C-H

1892-1942 • 50th ANNIVERSARY

opens contact Q_L in the shunt field circuit. A definite amount of resistance is thereby introduced into the shunt field which decreases the generator voltage. As the Q_L' contact in the relay circuit is in a closed position, the resulting decreased resistance in that circuit offsets part of the voltage drop across the relay caused by the decrease in generator voltage, thus eliminating hunting.

The control has application in manually operated as well as automatic plants since it can provide ample regulation in most cases of system faults.

•

Special Tool Treats Field Holes in Wood

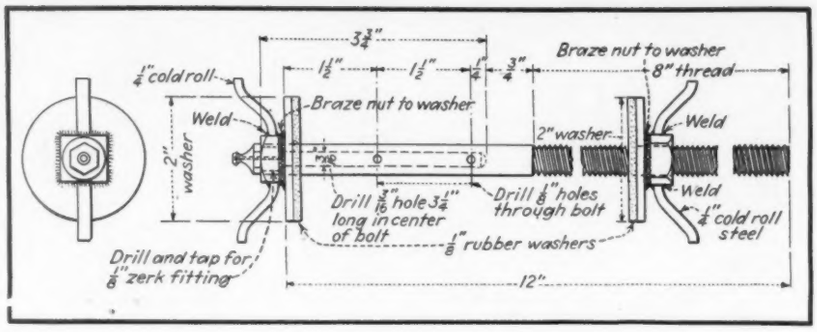
By H. N. FOX
Commonwealth & Southern Corp., Jackson, Mich.

A simple and inexpensive tool for treating field holes* in wood members is shown in the accompanying drawing. It consists of a ½-in. bolt, long enough to go through the largest member to be treated, and threaded down far enough to allow clamping on the shortest member to be treated. Head and unthreaded end of the bolt are drilled with a $\frac{3}{16}$-in. drill and the head tapped to receive a ⅛-in. Zerk type fitting. One or two cross holes are drilled in the main body of the bolt to let the treating material out into the hole in the wood.

To prevent the leakage of liquid at the surface 2-in. washers are welded to the underside of the head. A standard nut and some ¼-in. rods were welded to head and nut to form wing nuts. A standard wing nut could be used if available. Rubber washers are provided to make a fairly effective seal at the surface. Construction of this type will not make a perfect seal, but this is not necessary as the liquid penetrates into the wood fibers quite rapidly, and also there is no harm if there is a small amount of leakage.

The device is clamped through the hole to be treated and pressure applied by filling almost any good pressure gun with the treating liquid, although it is recommended that something better than the cheapest type of gun be used. It was found by experiment that the standard Alemite No. 6531 gun for liquid gave rather satisfactory results. On tests it was shown that it took only a few pumps from the gun to force oil through 2 to 3 in. of wood, along the grain. It is not recommended that such treatment be used on all holes, still it is thought that it will give considerable protection to such field holes that have to be added to a structure. Almost any type of treatment can be applied with such a gun as long as it is applied in the liquid state.

*See reference to this device in article entitled "Wooden Substation Saves Zinc, Steel,"—"Electrical World," April 18, 1942, page 100.



ADAPTER used with standard "grease gun" permits pressure treatment of field holes in wood with preservative. Device shown is for holes ⅝ in. or larger in 4 to 10-in. thick wood

• • •

A Typical Standard for Head Guys

Included in the overhead construction standards established by the New England Power System is one for head guys; that is, all guys with anchorage above ground.

This standard is set up as a unit and includes a diagram as shown, a table of parts used for various loads, and the following specific instructions or notes:

A. Std. 2339 shall be used for crossarm guys. Std. 2340 shall be used for light rural lines only.

B. Use second insulator only when supply conductors or communication lines are on or near the guy support. This insulator shall be omitted when the two insulators would be less than 8 ft. apart.

C. Refer to Std. 2300 (general instructions) for use of copper-covered guy strand; also guys where lines over 10 kv. are involved.

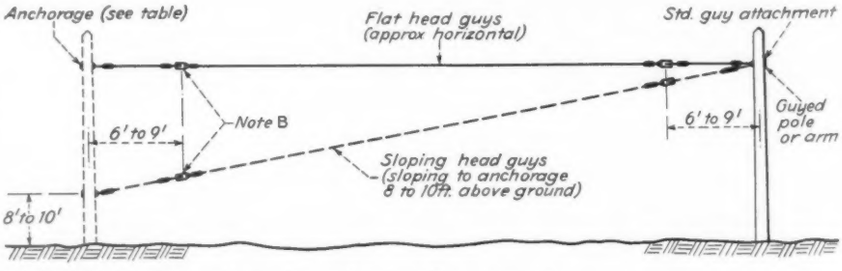

Anchorage (see table)
Flat head guys (approx horizontal)
Std. guy attachment
6' to 9'
Note B
6' to 9'
Guyed pole or arm
Sloping head guys (sloping to anchorage 8 to 10ft. above ground)
8' to 10'

DIAGRAM for pole guying with anchorage above ground

Table of Standard Head Guys for Various Loads

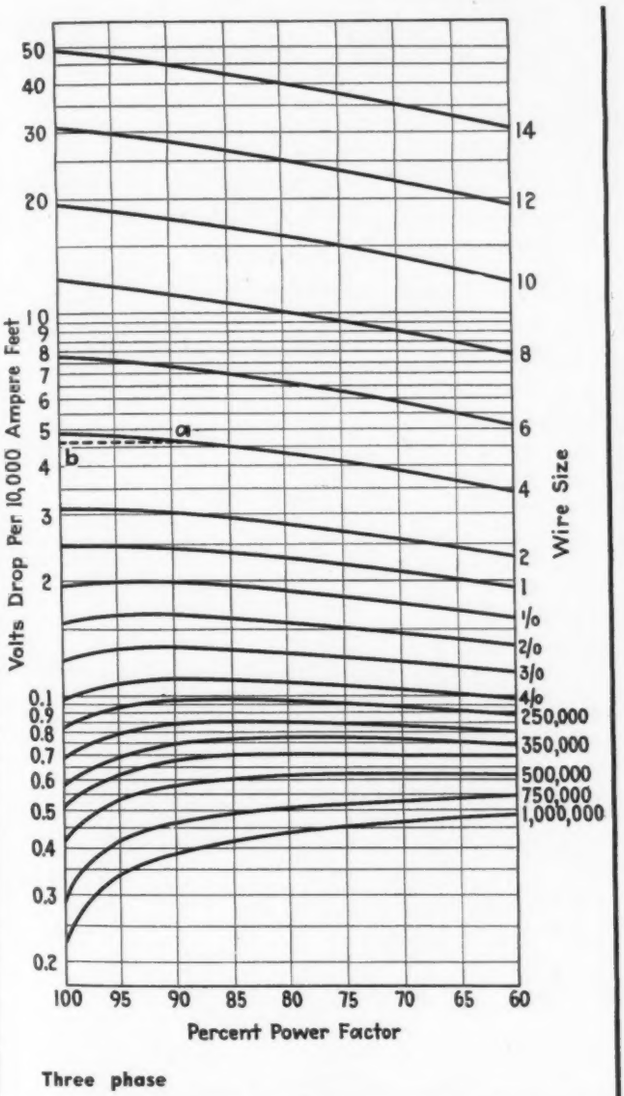
Standard No.	2339–2340	2341	2345	2347
Maximum load, lb.	1,100	3,400	7,000	11,000
Guy wire, description	3 str.—No. 11	$\frac{7}{16}$ in.—7 str.	$\frac{5}{8}$ in.—7 str.	$\frac{7}{8}$ in.—7 str.
Insulator	Refer to insulator list			
Clamp, No. per point	1	1	2	3
Clip	Refer to clip list			
Protector	When required			
Pole or arm attachment	Covered by Std. 2361–2363			
Anchorage	Covered by pole stub or tree Stds. 2324–2361–2363			

HOW TO MAKE

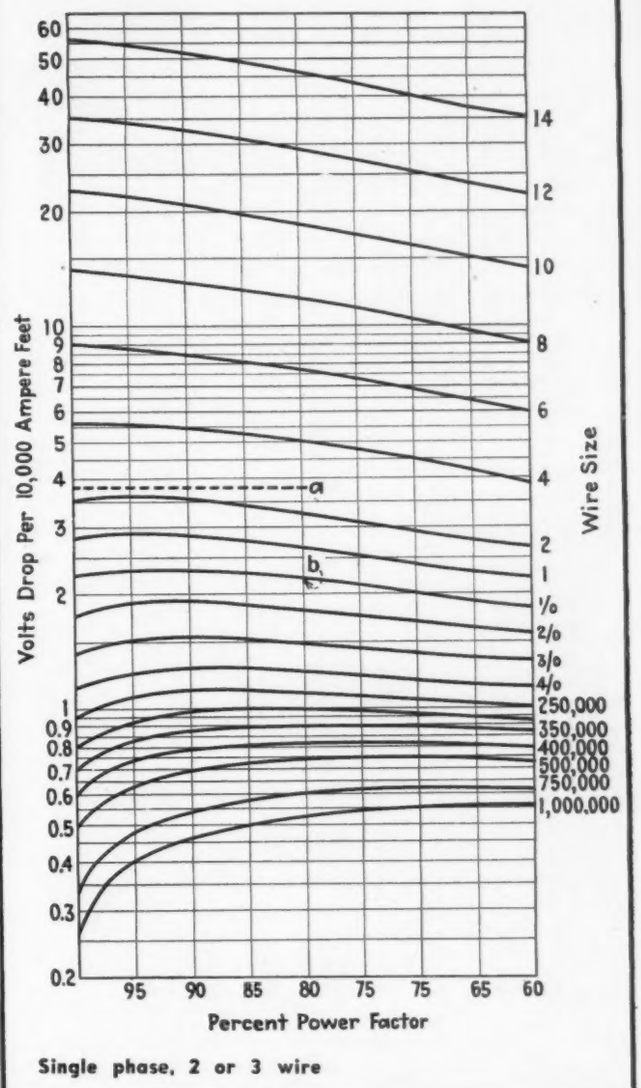
Voltage Drop Calculations for 60-Cycle Circuits*

Curves are based on "volts drop per 10,000 ampere-feet"; assume closely spaced conductors; i.e., contained in conduit, with a copper temperature of 49 deg. C. Any particular current, length of run and voltage drop must be stated or approached in terms of the unit, ampere-foot

EXAMPLES FOR USE OF CURVES



Three phase



Single phase, 2 or 3 wire

Problem: What load, with an average power factor of 90 percent, can be carried on a 3-phase, 4-wire, 120/208-volt, 60-cycle circuit of No. 4 conductors, without exceeding a 4-volt drop.

Solution: Follow the 90 percent power factor line vertically to the intersection with the line representing No. 4 conductors. This is at point *a*. From this point follow horizontally to the left and read 4.6 volts drop (point *b*), which will result from 10,000 amp.-ft.

For a maximum of 4 volts drop the total allowable ampere-feet is

$$\frac{4}{4.6} \times 10{,}000 = 8{,}700$$

To determine the current:

$$\frac{8{,}700 \text{ amp.-ft.}}{150 \text{ ft.}} = 58 \text{ amp.}$$

Then total load is

$$\frac{58 \text{ amp.} \times 120 \text{ volts} \times 3 \text{ (3-phase ratio)} \times 0.9 \text{ p.f.}}{1{,}000} = 18.8 \text{ kw.}$$

Problem: What wire size should be used to keep the voltage drop less than 3 percent on a total run of 175 ft., with a load of 21 kw. at 80 percent power factor on a 3-wire, 120/240-volt circuit? *Solution:*

$$\text{Current carried} = \frac{21 \text{ kw.} \times 1{,}000}{240 \text{ volts} \times 0.8 \text{ p.f.}} = 109 \text{ amp.}$$

And 109 amp. $\times$ 175 ft. = 19,100 amp.-ft.

Permissible voltage drop = 0.03 $\times$ 240 volts = 7.2 volts.

Voltage drop for 10,000 amp.-ft. should be limited to

$$\frac{10{,}000}{19{,}100} \times 7.2 = 3.8 \text{ volts}$$

Size of wire may be found at intersection of lines for 80 percent power factor and 3.8 volts, at point *a*. Indications are that No. 2 conductors should be satisfactory. However, determining factor is National Electrical Code, which requires No. 1/0 conductors for 109 amp. By the latter condition the actual voltage drop would be

$$\frac{2.2 \text{ (point } b\text{)}}{3.8 \text{ (point } a\text{)}} \times 7.2 \text{ volts} = 4.2 \text{ volts or } 1.8 \text{ percent}$$

* Adapted from charts of National Electric Products Corporation and "Handbook of Interior Wiring Design."

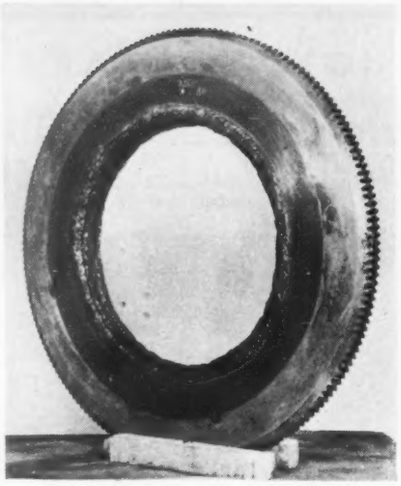
Breaker Worm Wheels Rebuilt by Welding

Older types of "H" breakers have the so-called "motor mechanisms" equipped with a free-wheeling device known as a worm wheel. Engineers of one utility, which has about 250 of these breakers in the system, have worked out an ingenious way to rebuild worn surfaces on the worm wheels by arc welding and thus avoid expensive replacement.

Hitherto an average of 30 worm gears and 37 sets of pawls had to be changed each year, according to records covering a thirteen-year period. New wheels cost about $40 each, while the arc welded repair method now used costs only $4.40—an average annual saving of more than $1,000.

The worm wheels consist of a hub and worm gear with driving rim. The hub contains six spokes and is fitted to carry pawls. Worm wheel specifications have been changed by the manufacturer from time to time. A considerable number of worm gear and driving rims, therefore, were giving trouble because the driving rim Brinell hardness was 150 or less instead of from 180 to 210. As the maximum recommended clearance between spokes and rim is only 0.010 in., a soft rim has a relatively short life.

Construction of the worm wheel, with its bronze ring upon which the gear is cut and its steel insert upon which the work is done, required careful welding procedure to avoid separation of the bronze ring and the steel insert. By the use of numerous thin beads in application of the weld metal the difficulty was overcome. In present practice seven beads are applied.

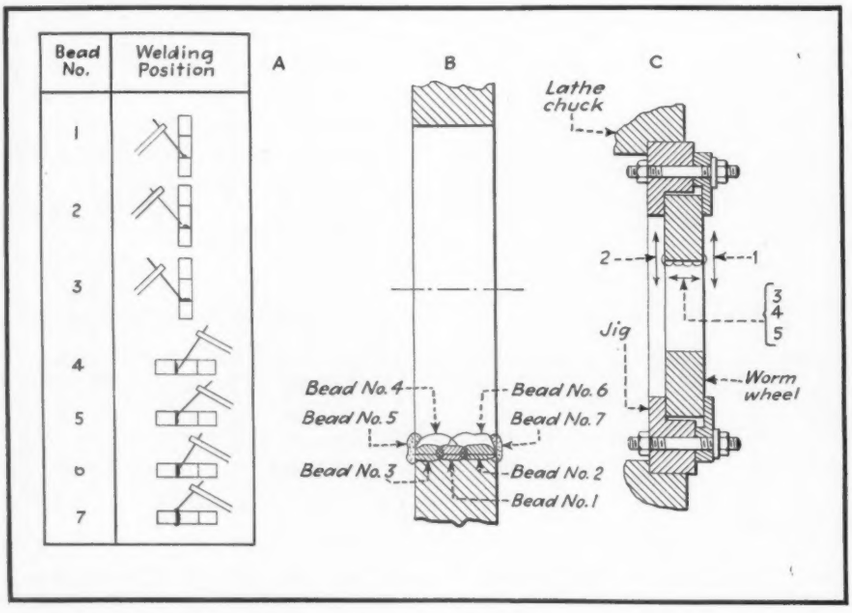


ARC WELDING relieved replacement jam of worn worm wheels; several of the seven beads are visible on this wheel, which is ready for machining operations

Repair of a wheel is accomplished by this arc-weld method in approximately 3½ hours, according to technicians of the firm. Of this time, about 45 minutes is required for welding, one hour for machine work on a lathe and 1¾ hours for dry grinding and finishing to a final internal diameter of 6.001 in. However, if available, a wet grinder is preferred and, it is said, will reduce the grinding time at least 50 percent.

Hardness tests show that the average Brinell hardness of the weld metal is 200, well within the limits set.

Welding and machining operations are outlined in an accompanying sketch. Rod used was Lincoln $\frac{5}{32}$-in. "Shield-Arc 100" electrode. The Lincoln welder was set in the range of 110–125 amp. at 25–30 volts. Reversed polarity with the rod positive and the work negative was employed.



WELDING and machining operations for reconditioning worm wheels or motor mechanisms of "H" breakers

A and *B* show welding positions and placements for seven beads. *C* shows location for the following machining operations: *1* and *2* machine face to original surface on both sides; *3*, rough machine bore leaving approximately 1/16 in. for finish machining; *4*, finish machine bore to finish diameter minus 0.005 in.; *5*, grind to finish diameter.

Making Capacity With a Contract

One of the largest public utility companies in the United States faces the prospect of having practically all of its rotating reserve absorbed by war loads which will come on the system within the next six months.

The management of this company firmly believes that other vital needs within its territory require that the company maintain some reserve generating capacity. However, with all of the present rotating reserves allocated and the practical impossibility of getting new generators within a reasonable period of time, the company has this month devised a plan which to the operating department at least constitutes a brand new source of reserve, especially for generators.

Here is the way that the plan works. A customer comes in and asks for 40,000 kw. of firm power. However, if the customer's business is of such a type that it can, in case of necessity, get along with something less than firm power, the company advances this proposition: "You can get along without service, if it should become necessary, for a period of extending up to X continuous hours. Why don't you agree to let us interrupt the service, if it should become necessary, for periods up to X hours and a commensurate adjustment will be made in your bill for service?"

The customer agrees, the contract is made and now the company has available instantaneously from this single contract a reserve of 40,000 kw. to be used in case of emergency, for

APPLIANCES IN USE

Electric's SERVICE Program!

THE uninterrupted use of every household appliance is essential to the maintenance of your domestic load. The uninterrupted use of every appliance is no less important to millions of American families who have learned to appreciate the health and happiness that come with electrical living.

In developing a service program that would be most helpful to thousands of retailers who formerly sold appliances ...and which, at the same time, would best serve the proud owners of millions of G-E Appliances... emphasis just naturally turned in the direction of *service training*. The need for strict conservation of critical materials also indicated the wisdom of doing everything possible to educate consumers in the proper use and care of equipment, and dealers in efficient and prompt repair of inoperative devices.

TRAINING ON MANY APPLIANCES

Consequently, training provides the bulwark of G-E's newly announced product service program. Already, most detailed and informative training programs have been written on G-E washers, ranges, refrigerators and Disposalls. As time goes on, instructive material on other products will be developed, so that a servicing utility may enjoy the benefit of the latest repair and maintenance technique uncovered by General Electric engineers and service specialists. Further, since training will be on a continuous basis, an "old" hand will have many opportunities to brush up on service, while the utility which is compelled to employ fresh and unschooled "hands" at frequent intervals will find G-E's new training program increasingly valuable.

Training, of course, is only part of General Electric's plan to keep load-building appliances operative. Through national advertising, consumer literature, and in many other ways, the story of use and care of time-saving G-E appliances will be told and retold.

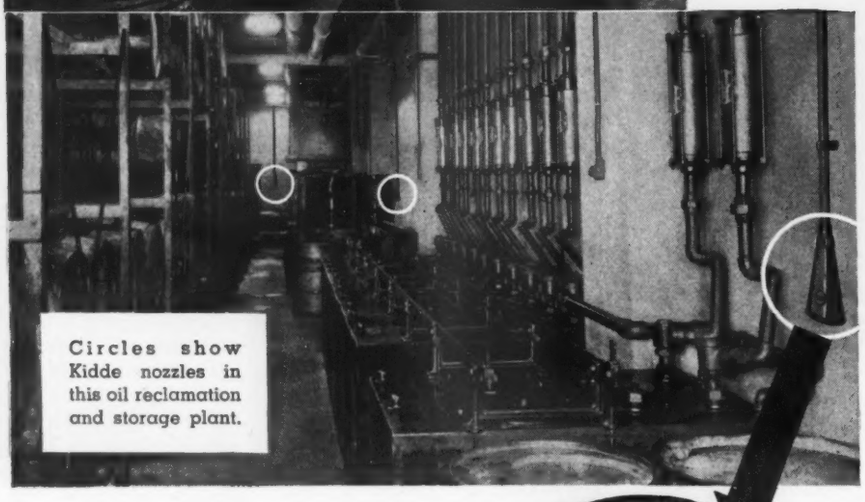
SALUTE TO SERVICE

This 12-page book states General Electric's service policy, shows the location of servicing agencies, and explains the operation of a typical Appliance Service Center. Write General Electric Co., Dept. 22-C, Bridgeport, Conn., for your copy.

These are typical scenes at a General Electric Refrigerator Training Service Meeting. Not only during classes...but after school, as well . . . a great deal of pertinent instruction is imparted to attentive service men.

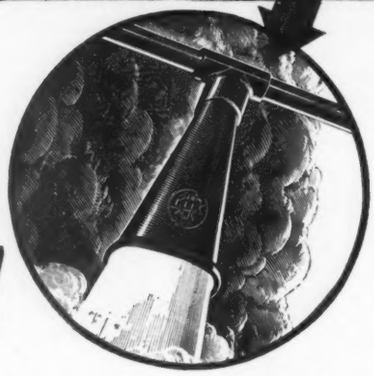
GENERAL ELECTRIC

WHEN YOU HANDLE OIL—



Circles show Kidde nozzles in this oil reclamation and storage plant.

BE READY TO HANDLE FIRE!



FLAMMABLE liquid fire hazards call for special and careful attention. Take oil, for example, as the public utility companies know it. It's tricky.

Oil switch rooms, transformer vaults, oil reclamation and storage plants may, in a few seconds, become infernos of flame and heat. These are spots where fires must be killed with maximum speed and minimum damage. Get the *built-in protection* of a Kidde Extinguishing System.

Best bet for these confined spaces where oil is the hazard is *total flooding, automatically controlled.* The Kidde System floods entire space with a blizzard of carbon dioxide gas. Fire simply chokes to death. Rate-of-temperature-rise actuators discharge Kidde System automatically a few seconds after fire breaks out.

With a Built-In Kidde System, there's nothing left to chance. A Kidde System won't get panicky, can't do the wrong thing. It's your best protection, when oil is the fire hazard.

Kidde

Walter Kidde & Company, Inc.

628 WEST STREET • BLOOMFIELD, N. J.

any period up to a maximum of X hours. A reserve of this size is of particular value should the company lose a generator.

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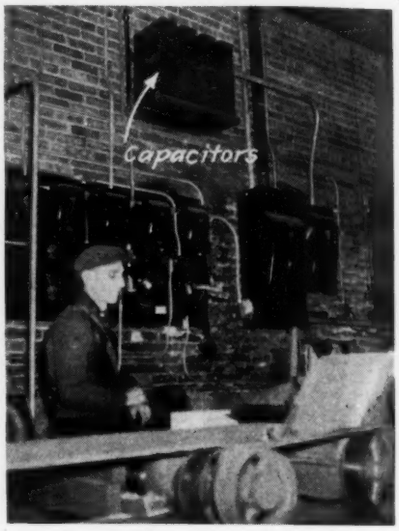
Capacitors in Ideal Location



Connected directly to the 480-volt feeder circuit supplying the bed stock department and located at the load center, this typical installation of four 15-kva. capacitors at the Brunswick-Balke-Collender Company, Muskegon, Mich., are in the optimum position to release carrying capacity of feeder copper by eliminating wattless current. Similar installations throughout the plant keep power factor between 90 and 95 percent. Since power rate to the plant is based on measured demand, high power factor results in good savings in the company's power bill.

•

Duplex Testing Increases Laboratory Production

At the Western Massachusetts Companies' meter laboratory in Springfield a new installation of test tables manufactured by the States Company, Hartford, Conn., according to specifications prepared by the utility has enabled the work of the department to be handled with increased rapidity, releasing space for special laboratory activities and affording a wide range of test facilities in connection with the new equipment. This included one special board for polyphase work (not illustrated) and two two-position ta-

1898 For the THIRD time 1917 SIMPLEX joins up— 1942

In 1898 and in 1917 Simplex did its part to win a war. Now Simplex has joined up to do it again.

THREE times during the past half century our Government has asked for and received the undivided support of the wire and cable manufacturers. In the present emergency the response is the same as it was in 1898 and 1917. For the third time Simplex has joined up.

There is a serious shortage of many raw materials and military requirements are tremendous. As a result we get less rubber, copper, tin and other items that we need and Simplex wires and cables are available only for the Government and essential industries.

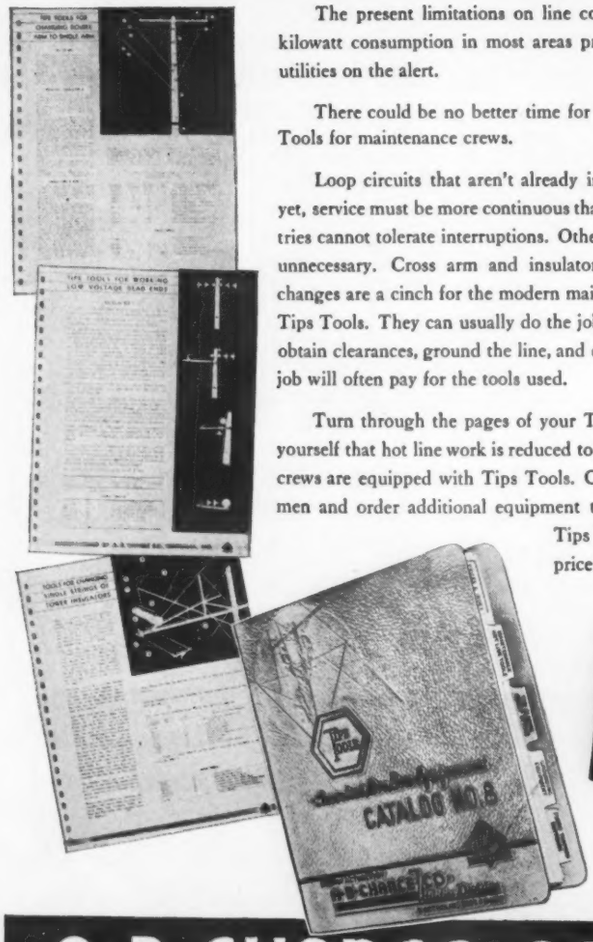
It will be very difficult to buy new wires and cables unless they are to be used on war work. Obviously it is more important than ever that those now in service be carefully maintained and promptly repaired if they become damaged. A careful inspection now may prevent future trouble.

The restrictions under which we now work have stimulated Simplex research activity and out of our experiences and experiments will come new and better Simplex products for the electrical industry after the war. In the meantime, we shall be glad to discuss with you any problem in connection with keeping your Simplex cables in service "for the duration."

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

Equip hot line crews while revenues are up and expansions are limited . . .



The present limitations on line construction and the increased kilowatt consumption in most areas presents a real opportunity for utilities on the alert.

There could be no better time for investment in Tips Hot Line Tools for maintenance crews.

Loop circuits that aren't already in are "out" for the duration, yet, service must be more continuous than ever before. Defense industries cannot tolerate interruptions. Other interruptions are costly and unnecessary. Cross arm and insulator changes or complete pole changes are a cinch for the modern maintenance crew equipped with Tips Tools. They can usually do the job in less time than it takes to obtain clearances, ground the line, and do the work cold, and a single job will often pay for the tools used.

Turn through the pages of your Tips Tool Catalog and see for yourself that hot line work is reduced to its simplest, safest form when crews are equipped with Tips Tools. Confer with your maintenance men and order additional equipment today while revenues are up. Tips Tools are still available at no price increases.

CONSULT THIS BOOK

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

bles utilizing the photoelectric method of timing.

Each of the two-position tables is equipped with two G.E. photoelectric devices and has two separate load banks, each with a capacity to test up to and including 50-amp. watt-hour meters of one, two and three elements and at potentials of 120-208 and 240 volts. Either of these test positions may be operated manually by the use of a potential switch or by photoelectric control, and through a double-throw switch the photoelectric control may be shifted from one position to the other, the reason be-

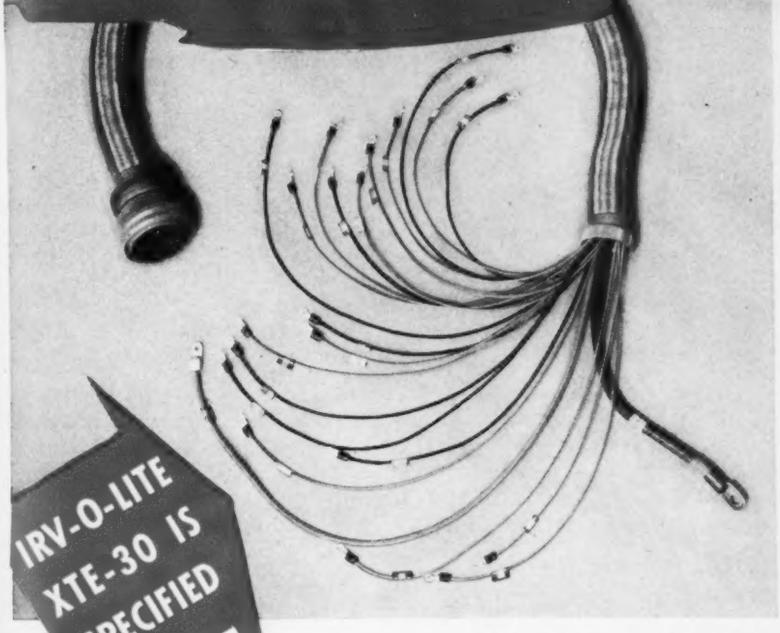
TWO-METER set-up per table permits utility to achieve larger test output with flexibility of use

ing to prepare and connect one meter for test while the other is being tested and adjusted.

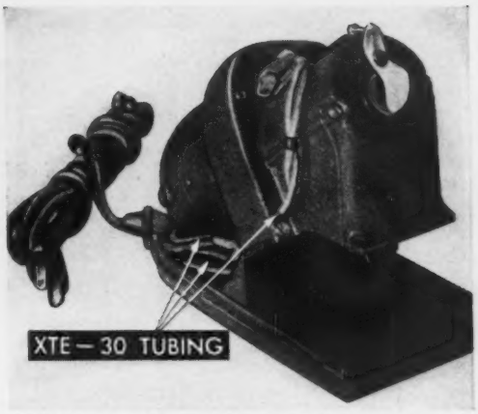
Two rotating standards are used in this set-up, one for each position, which makes it possible to test two meters simultaneously if it becomes desirable. Light-load, full-load and power-factor loads are controlled by one switch, and it is not necessary to change any standard connection in shifting from one load to another. A high-potential (1,500 volts) test is applied to the meter when installed in its test position to check the condition of the insulation between case and windings. This cannot be done without the use of both the operator's hands to close the circuit, thus eliminating danger to the operator. Above each half of the table is a 15-watt Daylite lamp for panel illumination.

The switches are of the dead-front type on an inclined control panel,

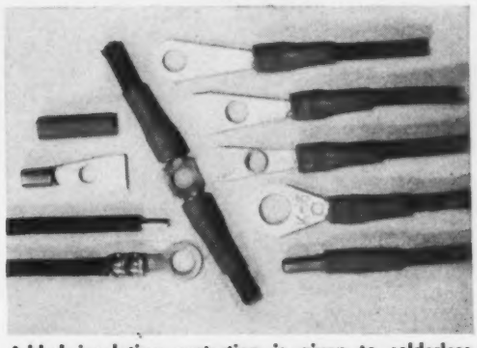
FROM PLANES TO PENCIL POINTERS...



XTE-30 Tubing used in wiring systems on prominent planes.



IRV-O-LITE XTE-30 provides insulation on the Triple "E" Products Company, St. Louis Electro-Pointer Pencil Sharpener.



Added insulating protection is given to solderless wiring devices with IRV-O-LITE XTE-30.

IRV-O-LITE XTE-30 is used as insulation on parts for famous planes.

On planes, pencil pointing machines and other equipment requiring protection of electric circuits, IRV-O-LITE XTE-30 Extruded Plastic Tubing provides lasting insulation. Many manufacturers of terminals, lugs, motors, electric appliances, electronic devices and instruments also use IRV-O-LITE XTE-30 to guard against short circuits and grounds caused by insulation failure.

The choice of IRV-O-LITE XTE-30 Extruded Plastic Tubing by so many companies in widely varied fields is accounted for by the advantages this Fibronized Tubing provides.

HIGH DIELECTRIC STRENGTH—Dry—750 VPM; Wet—350 VPM.

FLEXIBILITY—So elastic it can be flexed on itself with wire inside without cracking.

HEAT RESISTANCE—Withstands soldering temperature. Will not support combustion.

CHEMICAL RESISTANCE—is not affected by denatured alcohol, petroleum, gasoline, concentrated acids and alkalies, and most coal tar solvents.

TENSILE STRENGTH — 2150 lbs. per sq. in. IRV-O-LITE resists wear, tear and abrasion.

SMOOTH WALLS—Inside and out for easy assembly.

CONTINUOUS LENGTHS—Cut down waste.

SIX STANDARD COLORS—Colors: black, green, white, yellow, red, blue, simplify identification of wires after installation.

WIDE RANGE OF SIZES — From No. 24 to 1½" I.D.

This thin-walled tubing with its high dielectric strength saves space in intricate and crowded installations.

Test the qualities of IRV-O-LITE XTE-30 yourself. Write Dept. 46 for samples, complete product information and prices.

OTHER IRVINGTON TUBING

IRV-O-LITE XTE-100

For use where higher dielectric strength and temperatures are encountered

TRANSFLEX

The new transparent plastic tubing that resists brittleness down to —58° F.

STANDARD OF THE WORLD
IRVINGTON INSULATION
TRADE REG. U.S. PAT. OFF. MARK

IRVINGTON

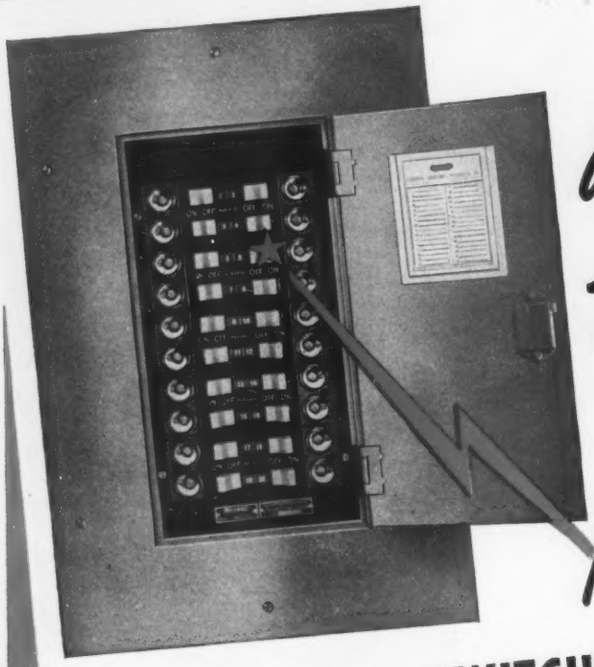
VARNISH & INSULATOR CO.

IRVINGTON, NEW JERSEY, U. S. A.

Plants at Irvington, N. J. and Hamilton, Ont., Can.

Representatives in 20 Principal Cities

FEDERAL
ELECTRIC PRODUCTS



at this point

THE "SAFETY SWITCHMAN" CARRIES THE LOAD

In Federal Panelboards, the "Safety Switchman" is an ingenious switch that stands constant watch ahead of every fuse. This means a higher safety factor and perfect control protection of lighting and small power circuits. Federal Type NTPR Panelboards—to handle from 4 to 40 circuits—are compact, ruggedly built, and approved by Underwriters Laboratories. They have quality construction features that you'd expect would cost considerably more. *For complete Federal panelboard specifications, write for Bulletin No. 21-40.*

FEDERAL PANELBOARD FEATURES

Shallow Boxes for Thin Wall Mounting • Large Wiring Gutters
Flush Locks and Catches, Concealed Hinges • Plenty of Knockouts
Solderless Terminal Connectors • Rugged Construction
Giant Switches • Low Cost

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
54 PARIS STREET, NEWARK, N. J.

Follow the Federal Line

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

loading current supplied by a transformer with resistance rack and adjustment by toggle switches in $\frac{1}{4}$-amp. steps.

J. Frank Murray, general superintendent of meters, states that the new tables do not occupy more than 34x76 in. floor space for each, and that the increased amount of testing which can be done on them depends on the types of meters which are handled and whether they are new from the factory or removed from the lines. Production can be increased as much as 70 percent over the old method by using the photoelectric system of timing in conjunction with the various improvements in the table design.

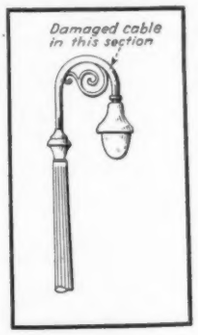
•

Splice Damaged Cable to Conserve Copper

By P. A. BURVANT
Assistant in Charge Street Lighting
New Orleans Public Service, Inc.

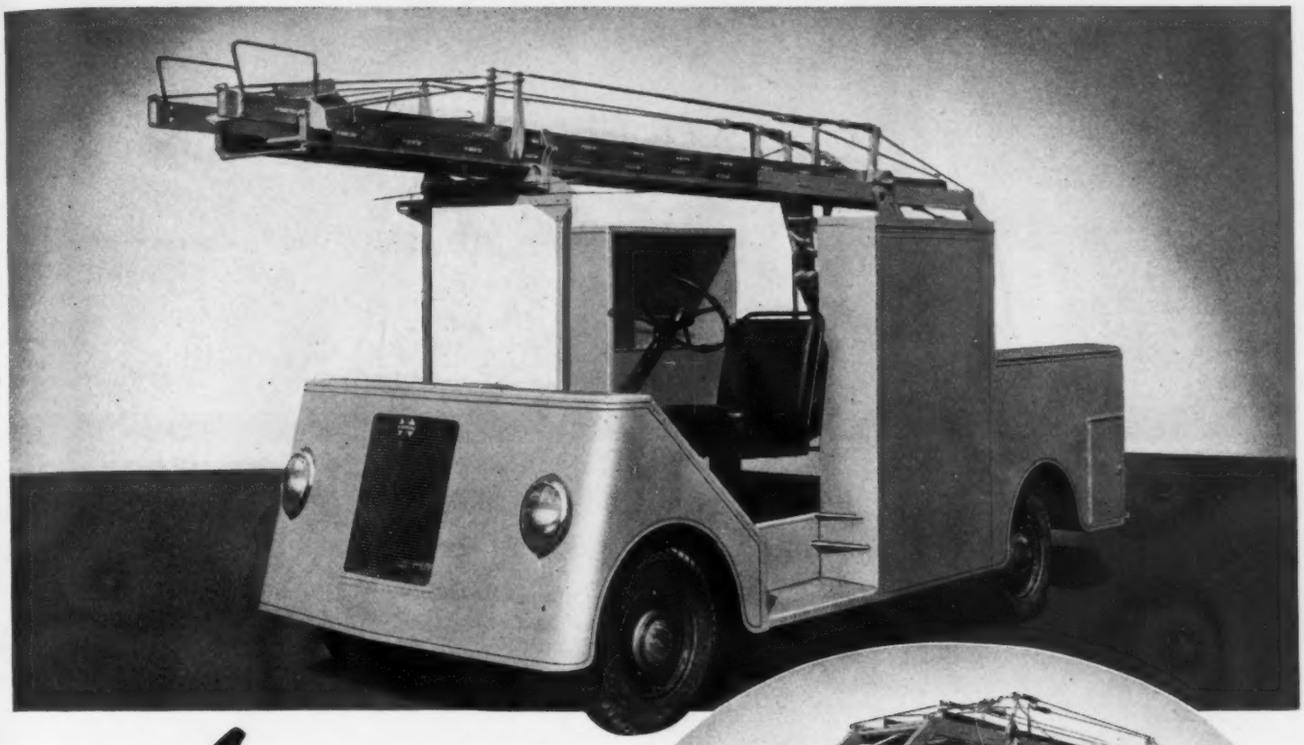
Conservation considerations have influenced methods used by New Orleans Public Service Company to repair cable in street light standards—which had been damaged by heat from street lamps.

Most of the damage to cable occurred in the foot or two of the gooseneck pipe bracket immediately adjacent to the luminaire as indicated. Formerly the entire length of cable was removed from the standard and a new length pulled in to replace it.



SAVE CABLE by splicing in street light standard to replace heat damaged portion; formerly pulled in entire new length

More recently, to conserve copper, only enough cable has been pulled from the gooseneck to expose the damaged portion completely. This short portion is cut out and replaced with asbestos-covered wire. The cable is then pulled back into the gooseneck (working from the base of the standard) and the canopy and luminaire are replaced. While the operation is not economical from a labor standpoint, it is effective in conserving the company's supply of cable.



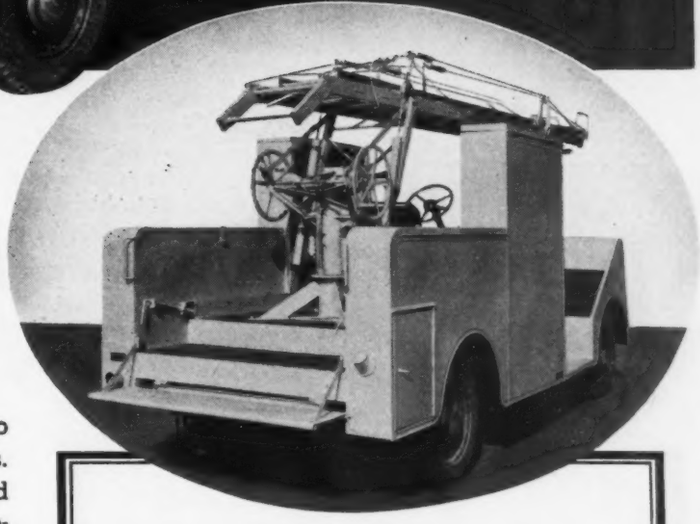
American

BUILDS SPECIAL BODIES FOR ALL PURPOSES!

American is continually being commissioned to build special bodies for new and unusual needs. With the largest plant in the country devoted exclusively to building bodies for motor equipment, and a staff of engineers of wide experience in designing all types of bodies, American is eminently qualified to build a body that will exactly meet your requirements and afford every advantage in efficiency, durability and low-cost operation.

WHAT IS YOUR PROBLEM?

Do not hesitate to put your requirements up to American. American engineers will be glad to advise with you, make preliminary drawings, and furnish estimates, without obligating you in the least.



FOR INSTANCE—

The unit here illustrated was specially built for installing and servicing fluorescent lamps in a large airplane plant. The fixtures are high above the floor, often directly above machines. Production must not be interrupted, even for a minute. The safety of the operator must be fully assured. The platform ladder can be elevated in 60 seconds to a working height of from 13 to 36 feet, at elevations between 30 to 75 degrees from horizontal. Compartments are provided to carry lamps and other materials safely and conveniently.

THIS UNIT CAN ALSO BE MOUNTED ON A TRAILER FOR HAND OPERATION ONLY

A C & B

THE *American* COACH & BODY CO.

WOODLAND AVE. AT E. 93rd ST., CLEVELAND, OHIO

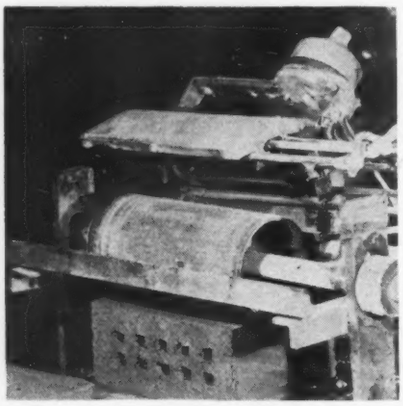
PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Electric Heat Units Improve Brick Finish

Use of electric heat in the manufacture of bricks at the Vernon plant of the Cleveland Builder's Supply Company has resulted in faster production and higher quality of work.



HEATING UNITS applied to inner side of semicircular metal plate of tile machine keeps roller warm and free from particles of clay

At this plant clay is forced through a metal die in an endless rectangular form, and then onto a conveyor which takes it to the cutting machine. To smooth the rough surface left on the face of the clay by the cutting machine the plant superintendent rigged up a roller which contacts the face of the clay as the form goes through the processing machinery.

However, loose particles of wet clay tended to stick to the roller, causing the surface of the finished brick to be marred. In an attempt to eliminate this condition heat from a torch was applied to the roller, but this proved unsatisfactory. Electric heat was then given a trial.

Four 750-watt Calrod heaters were mounted on the inner side of a semicircular metal plate which was erected directly above the roller. The electrically heated plate now keeps the roller hot and dry and entirely free from particles of clay, with a resulting improvement in the quality of the finished brick.

•

Light Sampler Convinces Grocers

A lone pork chop in a bed of greens under four different kinds of light in a typical display case set-up convinced grocers and butchers that there was something more to light and color than mere wattage.

The Pacific Gas & Electric Company's display man, Chad Hulbert, had built a simple compartmented display case to tell this story to the California Retail Grocers Association convention. In the case was mounted respectively, for the four compartments, incandescent lighting, soft white fluorescent, daylight fluorescent and 3,500-deg. K white fluorescent. An almost identical display of pork chop, greens and fruit was put in each compartment. Grocers could choose for themselves the lighting which they considered gave the merchandise the greatest eye appeal.

Further to emphasize the importance of lighting intensity, a large pallet of green, simulating an artist's pallet, but with various colored vegetables and fruit upon it rather than colors of paint, was set in a light box at the rear of the display. Four increasing intensities of lighting were put upon this to demonstrate that, with low intensities, some of the colors were scarcely distinguishable, whereas under high intensities all of the brilliance of the fruits and vege-

P·G·and E·
YOUR FOOD DISPLAY CAN BE A MASTERPIECE OF APPETITE and EYE APPEAL
BUT ONLY GOOD LIGHTING CAN MAKE IT SEEM AND GIVE IT BUY APPEAL

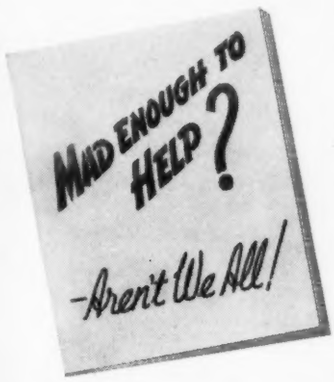
REPRODUCING in sample form a grocer's display case, Pacific Gas & Electric shows effect of various kinds of light upon merchandise

AT WAR

☆ ☆ ☆ ☆

Are you Mad enough to help?

HERE'S A COMPLETE WAR LIGHTING PROGRAM FOR UTILITIES!



Getting the right lighting in the right plants at the right time can help shorten and win the war. This places a big responsibility on the whole lighting industry. Who's going to do this job? How is it going to be done?

One thing we as the lighting industry *can* do, with our knowledge of the relation of proper lighting to increased production, is to step up our tempo of customer contact and service.

Another is to seek out all plants, large and small, faced with the problem of getting the most out of each shift, and make sure we are helping plant management remove bottlenecks that occur from improper lighting.

Another important job might be to organize in each community to see that every available man in the lighting industry both knows how to prescribe light for increased production and is out doing the job every day.

To help utilities do these jobs, the General Electric Lamp Department will gladly cooperate and offers suggestions and materials in the form of a complete program contained in the 14″ x 11″ folder illustrated at the left. Some of the supporting material is shown below.

Further information available through G-E Lamp Divisions. General Electric Company, Nela Park, Cleveland, Ohio.

SUGGESTIONS AND MATERIALS TO HELP WITH THE JOB!

1 **WAR PRODUCTION LIGHTING**—36-page, 8½″ x 10″ book on production lighting for war industry. Shows advantages of good seeing, points out lighting bottlenecks, how to smash 'em.

2 **MEETING GUIDE AND SLIDE FILM**—provides material for a talk to industry, built around a 50 frame slide film. Shows lighting bottlenecks and how to break them.

3 **WARTIME LIGHTING RECOMMENDATIONS**—is a four-page cover showing most types of general, local industrial and office lighting equipment. Holds forms for individual recommendations.

4 **LIGHTING CALCULATOR**—a handy slide rule for quickly determining the number of lamps and fixtures needed.

5 **SUGGESTED NEWSPAPER ADS** available in mat form.

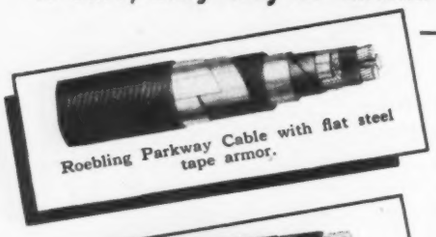
6 **WAR PRODUCTION LIGHTING HANDBOOK**—a condensed 200-page pocket size book, containing lighting data and information.

GENERAL ELECTRIC

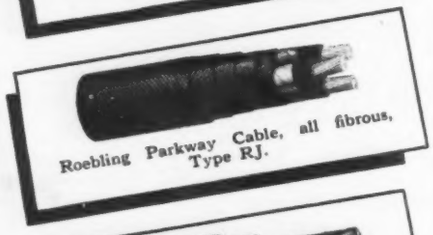
More Power to you with

ROEBLING
PARKWAY CABLES

A Safe, Easy Way to Extend Power Distribution Circuits
—WITHOUT CONDUITS OR MANHOLES!



Roebling Parkway Cable with flat steel tape armor.



Roebling Parkway Cable, all fibrous, Type RJ.

Roebling Parkway Cable—Roesheath with fibrous covering.

Roebling All Rubber Roesheath Parkway Cable, without fibrous covering.

TIME IS SHORT, materials must be conserved . . . so it's Roebling Parkway Cable being laid in a shallow trench to bring in dependable power for industrial flood lighting, signal and fire alarm circuits, series street lighting, airport lighting and a wide variety of other underground power circuits.

For extra protection against impact stresses, crushing or puncture—a steel armor tape is used. Where a lighter, more flexible cable is necessary, Roesheath (moisture-resistant rubber compound) cable eliminates sheath currents and corrosion, and is not subject to electrolysis.

These cables are available in single and multiple conductors, solid or stranded. With or without lead sheathing and metal tapes in a variety of insulations. Prompt shipment of war orders.

JR ROEBLING

JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY • Branches and Warehouses in Principal Cities

tables, all of their eye appeal, were brought clearly to view.

The display was made up in portable sections to be used at all similar conventions or meetings.

•

Indianapolis Survey of Appliance Usage

In planning for war-time ways of aiding residential customers in the use of their electric facilities, the Indianapolis Power & Light Company made a survey recently that indicated the value of special provision for the repair and redistribution of unused household appliances.

In the homes of 1,000 middle-class residential users of electric service covered by the survey a total of 8,397 appliances was found, or about 8.4 units per home. The survey included electric ranges, water heaters, refrigerators and ten other of the most common appliances, as well as I.E.S. lamps.

Of the total number of appliances 57 percent were less than five years old, 27.4 percent were five to ten years old and 15.6 percent were more than ten years old. However, 762 appliances, or approximately 9 percent, were reported not in active use, and of this number 205 were out of service because of need for repair and 557 for some other season.

War-Working Families

The last figure suggests that some means should be employed to redistribute to families which need them but will be unable to buy new ones during the war, the electric appliances in good condition which are not being used by their present owners. By setting up machinery for the resale of good second-hand appliances, reconditioned where necessary, families will not be deprived of such labor-having appliances as will release more of their energy and time for war work, especially on the part of women who undertake industrial jobs in addition to their housework.

The importance of adequate provision for appliance repairs, in which utilities and dealers can co-operate to keep electrical servants in good working order for the benefits of war-working families, also was shown by the Indianapolis survey.

The number of appliances not in

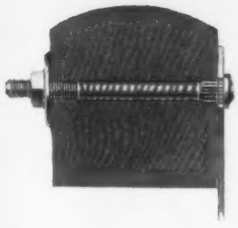
Oliver

QUICK-ASSEMBLY HARDWARE

...Cuts Maintenance!

In fact, you save two ways with Oliver Hardware. It installs faster and *stays* tight . . . eliminating this maintenance.

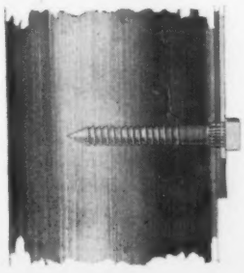
Beveled, easy-driving, "Speed-Point" Bolts go in faster . . . nuts thread-on from any angle . . . and washer-nut combinations save an extra operation and assure tightness. Oliver Cross Arm Brace Bolts with serrated under-head shoulders and hardened teeth, bite into cross arm braces and hold tightly. Investigate these features of Oliver Hardware . . . you'll find a low cost answer to your pole line assembly and maintenance.



This Oliver Drive-Grip Brace Bolt, with serrated under-head shoulder, bites into the sidewalls of the hole in the brace . . . stays tight. Catalog No. 5314 ½,—⅜" x 4½"—other lengths and diameters also available.

ELIMINATES RADIO INTERFERENCE

Tight hardware and equipment put a stop to many sources of radio interference. Oliver Hardware provides a sure solution to these complaints through its unique design features that assure tightness with minimum maintenance.



Oliver Drive-Grip Lag Screws, axe driven, make assembly fast . . . stay tight . . . eliminate maintenance. Cat. No. 5714,—½ x 4", —other lengths and diameters also available.

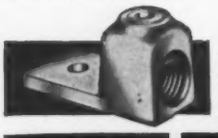
An exclusive development of Oliver pioneering and research is the serrated under-head shoulder that keeps Oliver Drive-Grip Bolts and Lag Screws locked tight by gripping the sidewalls of brace holes.

OLIVER
IRON AND STEEL
Corporation
Makers of Pole Line Hardware Since 1894
PITTSBURGH, PA.

APPROVED AND ACCEPTED SINCE 1894

SAVE TIME—select your conductor fittings from this Catalog . . **ALL** good types

You can buy Tee Connectors, Grounding Clamps, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Service Connectors, Bus Supports, Terminals . . . *practically every good type, in the COMPLETE line.*



JUST FOR EXAMPLE— here are some of the standard Penn-Union Vitite terminal lugs:

2-bolt flange

45° flange

Side flange

Center tongue

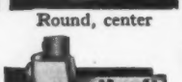
Round, 45°

Round, 90°

Round, offset

Round, center

These types and many more—in a *complete* range of sizes. Write for Catalog.



Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors. They have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

use, because of disrepair and other reasons, appeared to increase rapidly with the age of the appliance. Those in need of repair varied from 0.7 percent for appliances one year old to 6 percent for those ten years or more years of age, while the rate for appliances in good condition but not in active service rose from 2.3 percent for one-year-olds to 15 percent for those in the ten-year class. Considering that such increases occurred under normal conditions, when appliances could readily be repaired or replaced, it was assumed that the rise will be much more rapid when replacements are impossible and repairs more difficult to obtain, unless definite efforts are made to keep appliances in service.

•

Appliance Use Aided by Folders

In addition to a conventional series of newspaper advertisements advising domestic customers how to secure the best service and maximum use from their appliances under war-time emergency conditions, San Diego Gas & Electric Company is preparing a series of small folders covering specific appliances. Folders on the electric refrigerator and waffle iron have been printed, one on the electric toaster is in preparation and others are planned.

The folders contain suggestions regarding the best use of the appliances, ideas for additional uses, suggestions as to how the appliance can be maintained in the best working order, as well as descriptions of symptoms that indicate when service is needed. There are also recipes that have been tested and approved by the company's home service department.

Distribution of the folders is promoted in several ways. Their availability is announced in newspaper advertisements and over the air on radio programs. Supplies are also provided for dealer members of the San Diego Bureau of Radio and Electrical Appliances. More than 6,000 requests for copies of the waffle iron booklet were received following its original announcement.

46 Ways for your Automatic Refrigerator to Report for Xtra Duty
These Recipes have been tested and approved by the Home Service Department of the San Diego Gas & Electric Company
16 Welcome Ways to WAFFLE-IZE all size appetites
These Recipes have been tested and approved by the Home Service Department of the San Diego Gas & Electric Company.

TWO OF A SERIES of folders being prepared for customer distribution by the San Diego Gas & Electric Company to supplement conventional newspaper advertising on war-time use and care of appliances

Have you tried Scully?

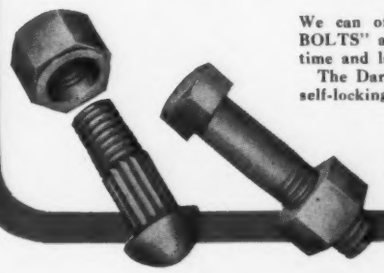
WE are not magicians, but we will do everything within our power to help you get the materials you need. We have stocks of many steels on hand, also tools, machinery and other equipment.

Be sure to try Scully — see our phone numbers below. Cut out the number of the warehouse nearest you and paste it in a handy spot.

Structural material
Plates, various qualities
Floor Plates
Sheets: Hot Rolled, Cold Rolled, Galvanized, etc.
Bars (all shapes): Hot Rolled Carbon and Alloy grades
Hot Rolled Strip Steel
Spring Steel · Tool Steel
Drill Rod
Cold Finished Bars, Carbon and Alloy grades
Wire
COR-TEN and MAN-TEN Shapes, Sheets and Plates
Abrasion-Resisting Sheets and Plates
Eaves Trough, Conductor Pipe
U·S·S Stainless Steel and Stainless products
Expanded Metal
Rails
Boiler Tubes
Rivets, Bolts, Nuts, Washers
Dardelet Rivet and Machine Bolts
Nails
Welders and Welding Accessories
Chain
Clamps
Flanges
Expanders, etc.
Hoists, Shears, Rolls, Punches, Cut-Off Machines, Saws, Nibblers, etc.

CHICAGO	**BRUnswick 2000**
Teletype CG. 605	
BALTIMORE	**GILmore 3100**
Teletype BA. 63	
BOSTON	**STAdium 9400**
CLEVELAND	**HEnderson 5750**
Teletype CV. 153	
PITTSBURGH	**CEdar 7780**
Teletype PG. 475	
ST. LOUIS	**MAin 5235**
MINNEAPOLIS - ST. PAUL	**NEstor 2821**
NEWARK, N. J.	**BIgelow 3-5920**
	BErgen 3-1614 - REctor 2-6560

IN STOCK! DARDELET "RIVET-BOLTS"



We can offer immediate shipment of both Dardelet "RIVET-BOLTS" and Dardelet Machine Bolts. These bolts save valuable time and labor and assure permanently tight joints.

The Dardelet "RIVET-BOLT" is a ribbed bolt with Dardelet self-locking thread, and is widely used for field erection of structural steel. Has recessed nut. Bolt is driven in and nut is applied with wrench. Economical and strong.

The Machine Bolt with Dardelet self-locking thread is for general use where vibration is present.

Scully Service

USS

We have a good stock of ELECTRICAL SHEETS in our Chicago warehouse

SCULLY STEEL PRODUCTS COMPANY

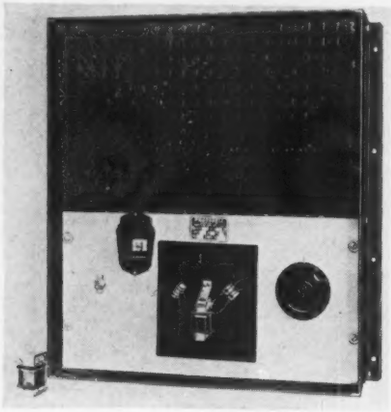
Distributors of Steel and Steel Products

UNITED STATES STEEL

NEW EQUIPMENT

Coil Testers

New line of coil testing machines quickly checks all of electrical properties of a coil in one handling. Two types of machines,



Semi-automatic coil testing machine; capable of making eleven tests on special three-winding coil at speeds up to 250 coils per hr. **Photobell Corp.**, 116 Nassau St., New York, N. Y.

automatic and semi-automatic, each have holders adapted to special shapes of coils to be tested. Tests are provided for checking limits of insulation resistance, coil resistance, effective a.c. resistance, inductance, shorted turns, effective turns, direction of windings, etc.

•

Grounded Ladder

Grounded ladder. **A. B. Chance Co.**, Utilities Div., Centralia, Mo.

Grounded ladder, to facilitate maintenance work on tower lines, H-frames and substations, has a flat iron bar running the full length of the ladder on both sides to add strength to the wood and distribute static electricity to the ground. Ropes can be anchored to rings at the lower rung to anchor the ladder.

•

Insulating Varnish

"S-110" insulating varnish. **Sterling Varnish Co.**, Haysville, Pa.

New insulating varnish is intended for application to electrical apparatus that must operate at abnormally high temperatures. Tests have indicated that the varnish will stand operating temperatures at 250 deg. C., or higher, according to the manufacturer. Baked at 175 to 200 deg. C., the dried film is stated to be mechanically strong, exceptionally adhesive and flexible, and to retain these qualities under adverse heat conditions.

•

Switchgear

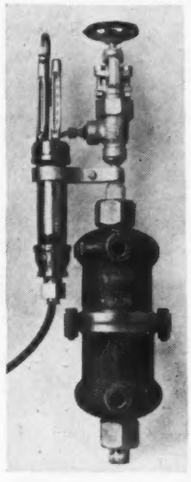
Type "MC-5" 250-volt d.c. air circuit breaker; metal-enclosed. **General Electric Co.**, Schenectady, N. Y.

Individual 250-volt d.c. air circuit breakers, together with control devices of contactors, are enclosed in separate steel compartments. Control switches and instruments are mounted semiflush on steel panels of door to control device compartments. Arc chutes lead out from top of structure.

•

Condensate Sampler

Condensate sampler for electrical-conductivity checkup of steam or other condensate operates in conjunction with suitable electrical instrument calibrated in direct-reading terms such as percentage of carry-over of soluble salts. Or, by a suitable device, a warning signal may be automatically actuated when condensate exceeds set limits or a corrective means set in motion admits condensate. Cell holder into chamber having conductivity cell at bottom. Thermometer indicates temperature of condensate.



Condensate sampler, combining condensate cooler and cell holder. **Industrial Instruments, Inc.**, Jersey City, N. J.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Vibration Study Aid

Vibration studies, stress and strain measurements and other investigations of low-frequency transient and recurrent phenomena may be facilitated with the aid of a low-frequency linear-time-base generator. Used in conjunction with an oscillograph provided with a long-persistence cathode-ray tube, or with photographic recording methods, the instrument provides a frequency range corresponding to rotating speeds of 12 to 7,500 r.p.m. Transient observation is provided for by a single-stroke sweep circuit.

Low-frequency linear-time-base generator; sweep frequency range from 0.2 to 125 cycles per sec.; maximum undistorted output signal, 450 volts, peak-to-peak; operates on 115 or 230 volts a.c., 40 to 60 cycles; 50 watts. **Allen B. Du Mont Laboratories, Inc.**, Passaic, N. J.

•

Starters

Oil-immersed starters; corrosion- and explosion-resisting styles; line-voltage, combination, reversing and two-speed starter types. **Square D Co.**, Industrial Controller Div., Milwaukee, Wis.

For applications where corrosive or explosive gases are present, these oil-immersed starters incorporate design features to aid installation, service and operation. Cast head with wiring manifold permits conduit entrance from five directions; removable cover plate facilitates threading bare wire through insulating spacer above oil bath. Magnetic overload relays are adjustable; hand or automatic reset types are available. Removal of tank from combination starter automatically throws breaker to "off" position.

"KEEP 'EM FLYING!"

You may have heard that Hubbard and Company has gone "all out" for the duration. You may also have formed the opinion that such being the case, Hubbard Pole Line Hardware might have become one of those war-time "hard to get" commodities.

You may be sure that we have turned over to war production, every facility that the U. S. Armed Forces have needed, and are working day and night to "Keep 'em flying." Otherwise, we would not have earned the All-Navy "E" for production, recently awarded to us.

But you may also rest assured that we are doing everything in our power to take care of our regular customers, as witness the huge stocks pictured above. In peace times our operation runs five eight-hour shifts per week. In these war times we are running twenty-one eight-hour shifts per week. Yes! we are working hard to "Keep 'em flying" but we likewise pledge every effort to you, our customers, to keep the freight cars rolling to meet your needs.

HUBBARD AND COMPANY

PITTSBURGH . . . CHICAGO OAKLAND . . . CALIFORNIA

RUBBER COVERED POWER CABLES • BUILDING WIRE

BARE WIRE • MAGNET WIRE • SERVICE ENTRANCE CABLE • NON-METALLIC SHEATHED CABLE • CRESFLEX

VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

It's a BIG ORDER, but

CRESCENT WIRE & CABLE

is helping meet the need

Miles of copper wire and cable go into the manufacture of America's great bombers, tanks and ships. More miles go into the huge new plants that are building these weapons for the great allied offensive to come. CRESCENT, as in the last war, is playing an increasing part in the effort to meet the demand for

ELECTRICAL WIRES AND CABLES

WAR PRODUCTION 100%

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESCENT ENDURITE SUPER • AGING INSULATION

Safety Transformer

Safety transformer; 1/10-kva. **Acme Electric & Mfg. Co.**, Cuba, N. Y.

Device reduces 110 volts a.c. to 32 volts to operate two extension lights for inspection or maintenance work where 110-volt lighting would introduce a shock hazard. Dual polarized secondary receptacles are mounted in one end of unit, which may be carried about the plant and plugged into any convenient 110-volt a.c. outlet.

•

Switches

New switches for relay circuits and other uses are available to provide "make before break" or "break before make" contacts, with spring return to normal position.

Type "RTS" push or pull type switches with spring return; supplied for 1/8 and up to 2 in. panel. **The States Co.**, Hartford, Conn.

Potential and current units in unit form and up to three units—equivalent of a 6-pole double throw switch—may be mounted with one mounting hole through the panel and operated with one knob.

•

Cable Paint

"No. 737 Black Cable Paint"; in one- to 55-gal. containers. **John C. Dolph Co.**, Newark, N. J.

Black cable paint developed by this company is stated to be oil and waterproof, flexible, flame-resistant within one hour after application, highly resistant to corrosive fumes and heat. For application to all cables—power, control, motor leads, splices, etc.—it is supplied at heavy brushing consistency and provides a build-up of 8 mils per coat. Air dries in 15 min. and may be thinned when necessary.

•

Industrial Lighting

"Compco R-F" luminaires; single and two 85-watt rectified fluorescent lamp models. **Commercial Metal Products Co.**, 2251 W. St. Paul Ave., Chicago, Ill.

New fluorescent luminaries for industrial lighting employ the Cooper-Hewitt full-wave rectifier-type circuit operating from a.c. supply. Company's 85-watt rectified fluorescent lamp for use in these luminaires has a rated light output of 4,000 lumens, with an efficiency of 47 lumens per watt. Unshielded reflectors use white porcelain enamel reflecting surface.

•

Blackout Marking

"Liquid Lighting". **Flame-Glo Co.**, Willow Ave. at 135th St., New York, N. Y.

Switch panel backgrounds, as well as other essential pieces of equipment will glow during a blackout if previously coated with this phosphorescent liquid coating. It may be applied with a spray or paint brush to interior or exterior surfaces; when dry and exposed to daylight or artificial light,

Horses Go By Wire

Daily millions of horsepower flow from power stations to points of production — over wires supported by Blaw-Knox transmission towers. And because these towers are extra sturdy, sound of design, carefully fabricated, properly galvanized . . . they withstand storm and flood and frost giving adequate service over long periods at low maintenance cost. Engineers and others interested in power transmission are invited to share the benefit of the great experience and unique facilities of Blaw-Knox in this field.

BLAW-KNOX TRANSMISSION TOWERS

AW-KNOX DIVISION OF BLAW-KNOX COMPANY 2013 FARMERS BANK BUILDING, PITTSBURGH, PA.
NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM

KLEIN'S

HELP SPEED HIS WORK

War has placed a new strain on communication systems—on power lines—on public utilities everywhere. The men responsible for keeping these services working at maximum efficiency are finding the hours in a day too short.

Under conditions like these, good tools are doubly important. The high quality, the extreme care in manufacture, the time-tested design that characterize Klein tools—all are proving their worth in aiding linemen and electricians everywhere.

ASK YOUR SUPPLIER

Foreign Distributor: **International Standard Electric Corp., New York**

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
1860 BELMONT AVENUE CHICAGO

it will give off an after glow during the night or blackout which is visible some 50 or 75 feet away, according to the manufacturer.

•

TECHNICAL LITERATURE

LIGHTING — Advantages of cold-cathode fluorescent lighting, with particular reference to industrial lighting, are presented in an 8-page folder issued by the Fluorescent Lighting Association, 509 Fifth Ave., New York, N. Y. Folder also deals with recent standardization of equipment and installation practices.

DISTRIBUTION — Means for insuring prompt and positive deenergization of distribution circuits during faults to ground, and performance of ground relays and other devices, are discussed in "Positive Disconnection of Distribution Circuits During Faults to Ground", Engineering Report No. 47 of the joint subcommittee on development and research of the Edison Electric Institute and Bell Telephone System. Copies—$1.50 each to non-members in the U.S.A.—may be secured from the E.E.I., 420 Lexington Ave., New York, N. Y.

PORTABLE SUBSTATIONS—Trailer-mounted portable substations in voltage ratings to 69 kv. and capacities to 4,500 kva. are discussed in the 8-page bulletin B-2281-A, available from department 7-N-20, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. Flow diagram shows cooling method employed.

DEFINITIONS—A new American standard, "Definitions of Electrical Terms, C42", sponsored by the American Institute of Electrical Engineers, is ready for distribution. Copies may be secured from AIEE headquarters, 33 West 39th St., New York, N. Y.; $1 each.

AUXILIARIES — Application of induction motors to power station auxiliaries is described pictorially in the 22-page bulletin GES-2536 prepared by the General Electric Co., Schenectady, N. Y. Bulletin includes tabulation describing motor characteristics of typical applications. Text tells what motor to select for the different drives.

CONSERVATION—"Conservation Folders" are being issued by Manning, Maxwell & Moore, Bridgeport, Conn. Typical titles: "How to Make Your Thermometers and Control Instruments Last Longer", "How to Make Your Safety and Relief Valves Last Longer".

CAPACITY — "How to Safely Stretch Steaming Capacity" is the timely title of Bulletin No. 16, 20-page booklet of the Bailey Meter Co., Cleveland, Ohio. Four rules are suggested: Check condition of boiler and furnace; check operating procedure; check modernization possibilities; base daily operation on accurate measurements and records.

RADIO INTERFERENCE—Causes and preventive methods for radio interference are discussed and described in the new 1942 edition of "Sprague Manual of Radio Interference Elimination". Booklet has been revised to include interference elimination from fluorescent lighting. Booklet is priced at 25 cents each by Sprague Products Co., North Adams, Mass.

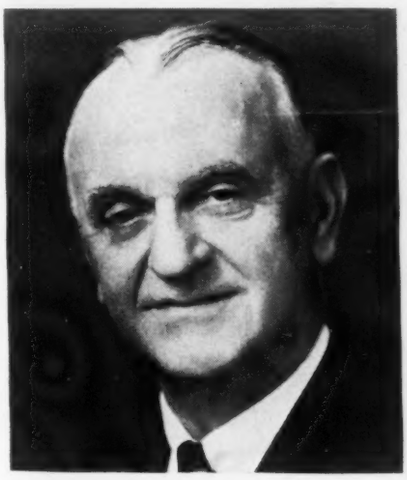
PLASTICS—Complete specifications for "Tenite"—Eastman's cellulose ester plastics—are detailed in "Tenite Specifications", 36-page booklet prepared by Tennessee Eastman Corp., Kingsport, Tenn.

NEWS ABOUT PEOPLE

S. E. Gates Elected Head of Pacific Coast Group

Sam E. Gates, Los Angeles, Calif., district manager of the General Electric Co. since 1924, was elected president of the Pacific Coast Electrical Association at the meeting held recently in Fresno.

A graduate of Purdue University, class of 1905, Mr. Gates entered the



General Electric test course following graduation. Two years later he entered the transformer engineering department, general office, and in 1908 was transferred to the switchgear engineering department. Mr. Gates was appointed manager of the Spokane office in 1910, the position he held until his assignment to Los Angeles.

•

▶ GUY E. NICKERSON, manager of the Amesbury (Mass.) Electric Light Co., a New England Power Association subsidiary operating in the Merrimac Valley, has been elected vice-president of the Amesbury utility.

▶ M. A. ULBRICH of the power engineering sales staff of the Cambridge (Mass.) Electric Light Co. has been elected chairman of the Power Engineers Association of New England. P. V. Hayden, Connecticut Light & Power, Danielson, Ct., has been named vice-chairman, and J. L. Calpin, Public Service Company of New Hampshire, Manchester, has been made secretary-treasurer.

•

E. R. Felber New Head of Wisconsin Group

Edward R. Felber, who was recently elected president of the Wisconsin Utilities Association, has been associated with the Madison Gas & Electric Co. in various capacities since 1922 and at the present time occupies the position of vice-president and sales manager.

Mr. Felber attended Armour Institute of Technology in Chicago prior to enlisting in United States Infantry Service. He was graduated from the engineering college, University of Wisconsin, in 1922. Mr. Felber has been active in state and national utility association committee work.

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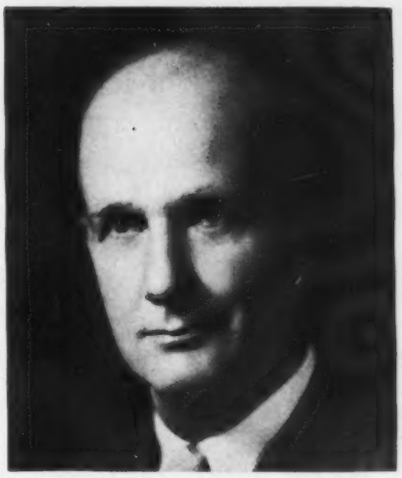
▶ MILO R. MALTBIE, chairman of the New York Public Service Commission, has received the honorary degree of doctor of laws from Upper Iowa University, Fayette, Iowa. Mr. Maltbie was honored on the fiftieth anniversary of his graduation from the university.

▶ R. A. WHITERSPOON has been awarded the Society of Chemical Industry (Canada) Medal for outstanding achievement in the electrochemical field. The presentation was made during the Canadian Chemical Convention held at Hamilton, Ont., last week. Mr. Whitherspoon was formerly chairman of the executive committee and president of Shawinigan Chemicals, Limited. He had been connected with the Shawinigan interests in various executive capacities since 1904, retiring from active participation in the company's affairs early this year.

R. E. Greene of Detroit Assigned New Duties

Ronald E. Greene, assistant construction engineer of the Detroit Edison Co. since 1938, has been appointed construction engineer, succeeding the late Arthur S. Douglass.

Mr. Greene became identified with the Detroit utility company in 1926 when he entered the engineering divi-



sion. Four years later he was appointed senior engineer. In 1937 Mr. Greene was transferred to the drafting and surveying bureau as assistant chief draftsman, and the following year he was appointed assistant construction engineer.

A native of Hudson, Mass., and a graduate of Worcester Polytechnic Institute in electrical engineering, Mr. Greene was identified with the General Electric Co. before joining Detroit Edison, first on the test course at Schenectady and later in the central station engineering department.

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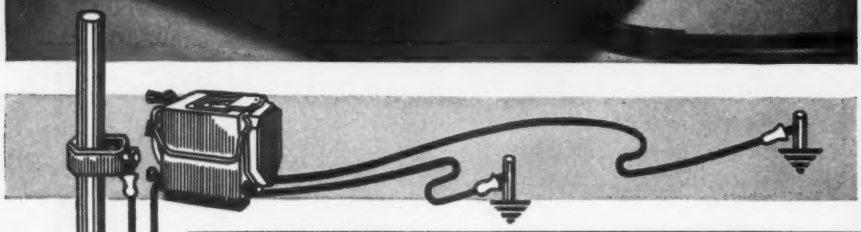
▶ HOWARD E. STOCKWELL, meter superintendent of the Connecticut River Power Co., Littleton, N. H., has been appointed to a similar post at Shelburne Falls, Mass., in connection with



"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF.
GROUND TESTER

For Measuring Resistance to Earth of All Types of Electrical Ground Connections.

1. Direct-reading in ohms—"like a voltmeter".
2. No calculations.
3. Only one set of connections.
4. No adjustments or "balancing".
5. Covers a wide range of resistance.
6. Unaffected by stray current in the earth—either a.c. or d.c. or by polarization or electrolysis.
7. Unaffected by the exact resistance of the reference grounds.
8. Has its own hand generator; requires no batteries or other external current supply.
9. Self-contained, rugged and portable.
10. Represents only a small fraction of the cost of adequate grounding protection.

FOR SAFETY AND PROTECTION TO LIFE AND EQUIPMENT

As simple, rugged and reliable for ground resistance measurements as are our "Megger" instruments for testing insulation.

Write for illustrated Catalog 1645-W describing the "Megger" Ground Testing Instruments.

James G. Biddle Co.
1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

the New England Power Co. and other New England Power Association properties in that area.

•

G. B. Regar Relinquishes Duties in Philadelphia

G. Bertram Regar, who has been assistant to the vice-president of the Philadelphia Electric Co. in charge of sales since 1937, retired from active employment on June 1 due to prolonged illness, after more than 36 years of service.

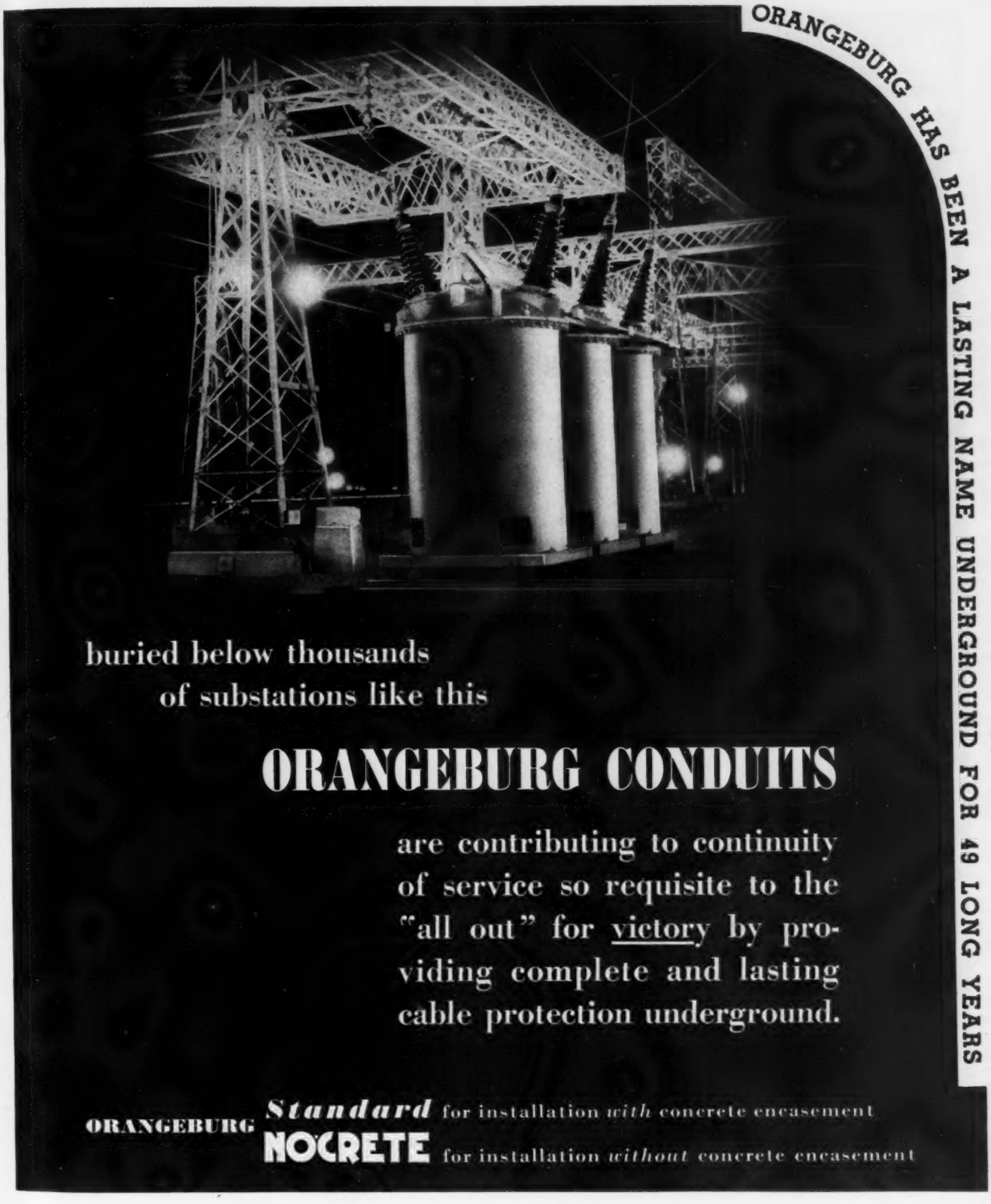
His entire career was associated with the development and promotion of lighting. He became affiliated with the company as an illuminating engineer, and in 1916 was appointed manager of the lighting service division.

Mr. Regar joined the Illuminating Engineering Society at the time of its organization in 1906, served on many of its committees, both locally and nationally, and was national president in 1936–37.

•

▶ GERALD Z. WOLLAM has been appointed works manager of the new war production plant of the Westinghouse Electric & Manufacturing Co. in Sunbury, Pa. Mr. Wollam, formerly assistant manager of the radio division of the company, will supervise the conversion of the idle Sunbury plant to manufacture bulkier types of communication equipment for the government.

▶ GEORGE W. FUCHS has been appointed assistant emergency defense coordinator for the Philadelphia Electric Co. system. In this capacity he will assist John S. Wood, the defense coordinator, in the handling of war emergency activities within the company. Mr. Fuchs was graduated from the University of Pennsylvania. He entered the Philadelphia Electric service as an engineer in training in 1922, subse-



ORANGEBURG HAS BEEN A LASTING NAME UNDERGROUND FOR 49 LONG YEARS

buried below thousands
of substations like this

ORANGEBURG CONDUITS

are contributing to continuity of service so requisite to the "all out" for victory by providing complete and lasting cable protection underground.

ORANGEBURG *Standard* for installation *with* concrete encasement
NOCRETE for installation *without* concrete encasement

Build for tomorrow with

ORANGEBURG *Conduits*

MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVENUE, NEW YORK CITY

Sales Agent—Distributors

GENERAL ELECTRIC SUPPLY CORP.
(and associated houses)

GRAYBAR ELECTRIC CO., INC.
(offices in principal cities)

6-FC-1

Here's An Amazing Performance Story—

—80 FOOT-CANDLES of INDIRECT ILLUMINATION USING ONLY 4.9 WATTS PER SQUARE FOOT!

Guth FLU-O-INDIRECT

Trade Mark & Patents Pending

THIS Data on GUTH FLU-O-INDIRECT installation speaks for itself. The Report was written by Mr. J. M. Guillory, Manager Industrial and G&M Sales Division, New Orleans Public Service Inc., and refers to an installation of Indirect Lighting in a Drafting Room working on Defense Production. The installation was made by L. M. Tognini.

"The average intensity as measured with the G. E. Light Meter, with a multiplier, is approximately 80 foot candles. The ceiling-brightness is not objectionably bright and the light-distribution is very uniform. The Draftsmen are highly pleased with the installation and find a complete absence of shadows, no reflected glare and excellent visibility of penciled lines on tracing paper."

Complete data for the installation is as follows:

AREA—776 Sq. Ft.
CEILING HEIGHT—10' 6"
MTG. FROM CEIL.—3' 0"
SPACING BETW. ROWS—8' 0"
UNIFORM ILLUMINATION AVERAGE—80 F. C. (after 100 hrs.)
TOTAL No. OF UNITS—16
TYPE UNIT—GUTH M2320
WATTS PER SQ. FT.—4.9
LAMPS USED—100W White

GUTH FLU-O-INDIRECT Luminaires are modern in design. They can be used for individual or continuous installation, requiring only one outlet per unit or run. Write for details.

The biggest part of GUTH Lighting Equipment is now produced for wartime purposes.

40th Anniversary of Guth Lighting Leadership

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

quently being named a station inspector, and a senior engineer. Later he entered the accounting department.

OBITUARY

James G. White

James G. White, internationally known engineer, who died on June 2 at his home in Greenwich, Conn., at the age of 80, early recognized the commercial possibilities of electricity and developed a large organization to finance, build and operate.

He was born at Milroy, Pa., and was graduated from Pennsylvania State College in 1882. Later he entered Cornell University, receiving a fellowship in electrical engineering, followed by the degree of PH. D. In 1887 he joined with others in organizing the Western Engineering Co., which did a considerable amount of construction work, and when the company was sold to the Edison-United Manufacturing Co., Mr. White went to New York to take charge of the department of electric railway installation. Upon the formation of the Edison General Electric Co. he resigned to develop an engineering and contracting business of his own under the name of J. G. White & Co.

In 1900, after having carried on from his New York office and by several trips to London a considerable amount of engineering in Australia, he established an office in London, organizing for this purpose the English company, then known as J. G. White & Co., Ltd.

In 1913 he formed the J. G. White Engineering Corp. as a subsidiary of J. G. White & Co., Inc., for the purpose of assuming the functions previously exercised by the engineering and construction departments of the parent company, which has since restricted its activities to the investment banking field. A large amount of work has been carried out by the J. G. White Engineering Corp. in the United States,

The GUARDSMAN

"STEEL-SAVER" FILES

THE SHARP STAB of war focuses the will and power of America on one word: VICTORY! We'll all make sacrifices, cheerfully, enthusiastically. But, through the ingenuity of Remington Rand researchers and designers, *you need not* sacrifice the *steel* files' efficiency.

The GUARDSMAN—"Steel-Saver" File—is constructed of wood—3-ply and 5-ply. It looks like a steel file and for durability, ease of operation, attractiveness, in all essential features, it is the equal of *best* grade steel files. *And it costs no more!*

The GUARDSMAN—"Steel-Saver" File—has been designed for addition to existing steel file batteries—four drawer heights, letter or legal size. Standard finish is olive green. Walnut or mahogany grainings are applied identically as on steel. The exteriors can't chip or crack. Hardware and drawer-pulls are a new, beautiful metal-like, strong plastic.

GUARDSMAN drawers operate on a new type of ball bearing extension slides. Less effort is required to open or close these drawers than *on any other file!* Locking devices can be installed.

Filing cabinets *are* essential to American VICTORY! You *can't* operate without them! Here then is the ideal solution to conserving steel and increasing the efficiency of our all-out war drive.

Write today for a free, fully illustrated catalog, that describes construction, design, operating advantages and clerical efficiencies of the new GUARDSMAN—"Steel-Saver" File. Remington Rand Inc., Buffalo, New York.

**The overwhelming, overnight popularity of the GUARDSMAN—"Steel-Saver" File—has caused the step-up,* many fold, *of our original production plans, releasing multi-millions of pounds of steel for defense industries!*

★ ★ **REMINGTON RAND** *"Victory is Our Only Objective"* ★ ★

WAR IS TEACHING US *this lesson!*

NOW, when speed and efficiency mean so much, we all recognize eye-fag as a sly enemy—a saboteur that wastes our time, effort, and materials. We're learning how better illumination can be put to work to speed hands and increase accuracy—to boost production! The "good lighting" of a few years ago is no longer considered good illumination.

A typical new fixture aiding war production is the Goodrich Highlite, shown at right. Where skilled workers need high intensities with protection from glare, this deep-skirted reflector hides the light source from the field of vision. The heavy glass cover makes cleaning or maintenance a quick and easy operation.

It is but one of hundreds of sizes and styles of Goodrich porcelain enameled fixtures which meet every industrial lighting need. Literature on request.

Protecting vital plants with flood-lighting—saving man-hours in production — Goodrich Industrial Fixtures are serving America's war effort everywhere.

Goodrich Highlite Reflector

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH ELECTRIC COMPANY

OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4626 BELLE PLAINE AVENUE, CHICAGO, ILL.

Canada, Central America, South America, Cuba, Puerto Rico and the Philippines. Mr. White retired from business in 1928.

During his engineering experience Mr. White supervised the design and construction of a large number of power houses, both steam and water driven, as well as complete systems of track and overhead construction, bridges, electric light and railway distribution circuits, while a number of the more important installations received his personal attention.

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J. Irvine Lyle

J. Irvine Lyle, president and a founder of the Carrier Corp., Syracuse, N. Y., died in that city on June 7, after an illness of three months. He was 68 years of age. Mr. Lyle collaborated with Dr. Willis H. Carrier, now chairman of the board of the corporation, in developing a scientific air conditioning system, and later they formed the Carrier Engineering Corp. Mr. Lyle was general manager and treasurer of the company until 1930, when it became the Carrier Corporation with him as president.

Mr. Lyle was born in Kentucky and received bachelor's and master's degrees in engineering from the University of Kentucky. He was the inventor of several devices dealing with atmospheric control and was the author of technical papers on air conditioning and related subjects. He was a past-president of the American Society of Heating and Ventilating Engineers and of the Refrigerating Machinery Association.

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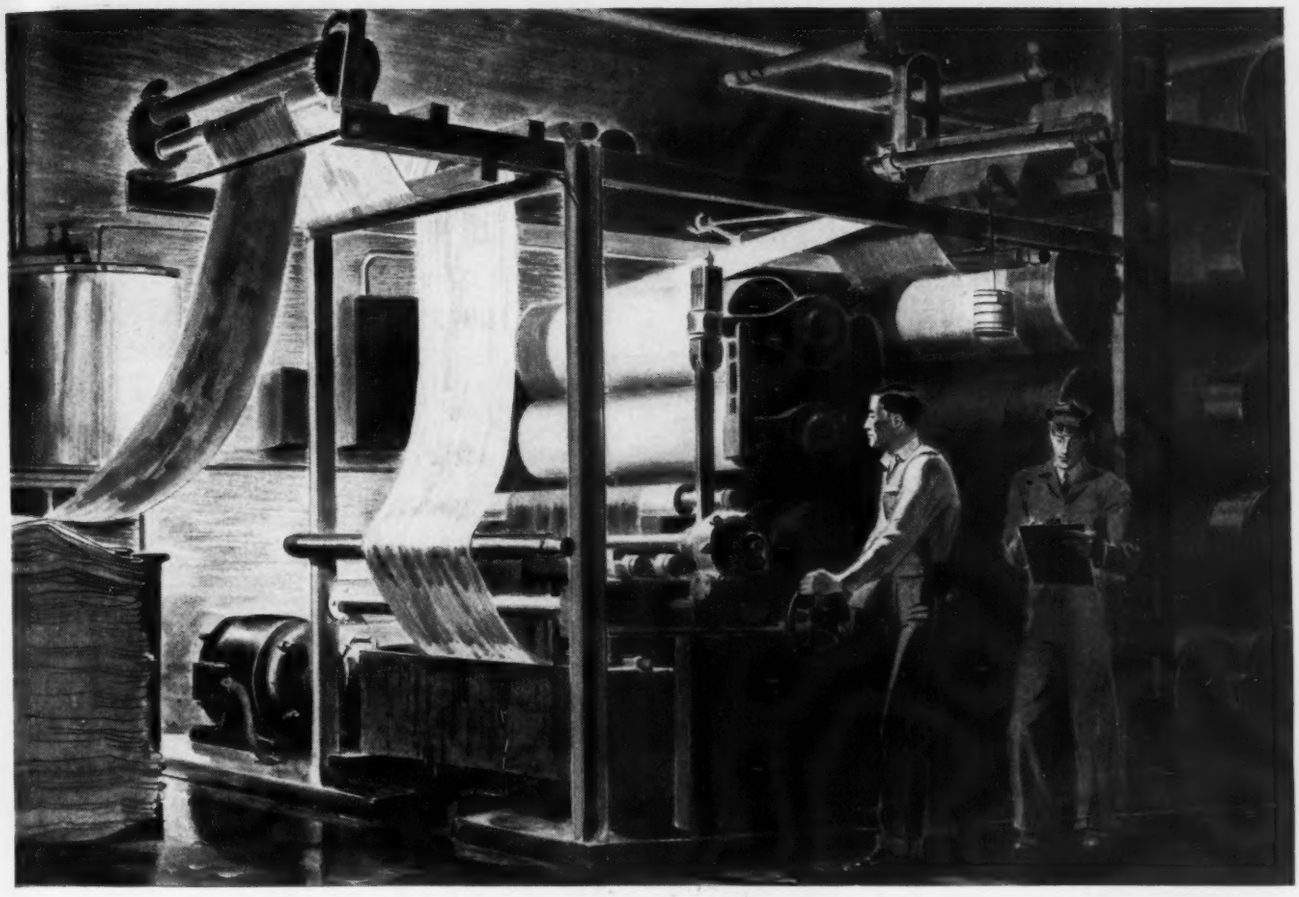
▶ PATRICK KELLY, managing director of the Edison Swan Electric Co., Ltd., of London, England, and a former executive of International General Electric Co., died on April 5 in England as the result of a heart attack. In addition to his position as head of Edison Swan, a subsidiary of the British Thomson-Houston Co., Ltd., Mr. Kelly was chairman of the Cable Manufacturers Association and a member of the council of the Electric Light Manufacturers Association. Mr. Kelly, a United States citizen, was born in India. After completing early schooling and college he joined the General Electric Co.'s construction department in New Haven, Conn., in 1914. Subsequently he became identified with a New York engineering firm, but returned to the New Haven office in 1915. Joining the British Thomson-Houston Co., Ltd., he went to India as manager of the Bombay office in 1920. Three years later he was as-



The motors that licked the "time killers"

Caustic fumes...heat...were causing frequent insulation failures. How electrical engineers stopped them with the help of Fiberglas:

★ ★ ★

A southern finishing mill converts khaki for Uncle Sam from grey goods. Motors in their plant are constantly sprayed by steam and caustic fumes. Combined with extreme temperatures, the fumes caused motor-insulation failures every 4 to 6 months and were terrific "time killers." Beginning two years ago, the mill had its electrical shop start rewinding its motors with Fiberglas. 60 have been rewound with the result to date . . . no insulation failures . . . no wasteful downtime.

★ ★ ★

GETTING MOTORS back into service—and *keeping* them from killing precious production time—is an even more important job today than in peacetime. For, today, electrical equipment is the vital source of power for our war-production machine. When it isn't in service, it's a boost to the enemy.

Electrical men are devising methods and techniques to prevent such loss of production and valuable time. One tool they are using in ever-increasing volume is Fiberglas. As a component of electrical insulation, it is already helping keep peak production for the victory we are determined to win.

Engineers have skillfully used this material . . . which is unaffected by high temperatures . . . by corrosive chemicals, and moisture, as part of the insulation in electrical equipment that must operate in tough surroundings without frequent failures.

There is a Fiberglas product for every electrical insulation need . . . tapes, sleevings, tying cords, cloths—Fiberglas-backed mica combinations—Fiberglas-base laminated materials—saturated and varnished tubing and Fiberglas-insulated magnet wire.

Consult your electrical manufacturer or service repair shop about Fiberglas-insulated equipment. The next time a problem of tough surroundings comes up in your plant, remember how forward-looking engineers are solving similar problems in many industries. *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

•T. M. Reg. U. S. Pat. Off.

OWENS-CORNING

FIBERGLAS

FAST, SIMPLE INSTALLATION *with* O. Z. TERMINATORS!

ASSEMBLY SERIES

Bronze belling ring with proper size hole is passed over the cable and set into end of the conduit.

Lead sheath is cut and belled over on the flat, unobstructed surface of the ring.

Pressure ring is placed over the belled lead sheath, preventing tearing and grinding of sheath when body is screwed down.

Malleable iron body is screwed directly on the conduit clamping and grounding the lead sheath. The lead sheath acts as a gasket and seals the end of the conduit.

Body is filled with properly heated compound. This seals the end of the cable, and further seals the conduit.

Canvas bakelite top cover is passed over the individual conductors, set into the body and secured by set screws.

Send for Bulletin

"O. Z. Terminators combine compactness with ease of installation. Are available in types for one or more cables up to 2500 volts." *Says the Wizard of O-Z*

O. Z. ELECTRICAL MFG. COMPANY

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Representatives in Principal Cities

2335

signed to the Schenectady office of I.G.E. After service in the London and Paris offices of I.G.E. he was appointed head of merchandising sales of British Thomson-Houston in London. He then became managing director of Edison Swan. Mr. Kelly was 53 years of age.

•

Henry A. Lemmon

Henry A. Lemmon, 69, president of the Sierra Pacific Power Co. (Nev.), died at his home in Reno on May 28 following a heart attack. He had been in ill health for several months.

Born in Sierra Valley, Calif., Mr. Lemmon began his career as a newspaper editor and publisher and entered the power business in 1906 as Nevada representative for the late Frank G. Baum, hydro-electric engineer.

In 1907 he was employed by the Nevada-California Electric Power Co. as agent and later he became associated

with the Reno Power, Light and Water Co., a predecessor of Sierra Pacific Power.

When the United States entered the first world war in 1917, he left the power company to do war work. He served as food administrator for Nevada and directing head of the Nevada council of defense.

In 1919 Stone and Webster sent him to Halifax, Nova Scotia, as sales manager for the power company there, and a year later he became personnel manager for all Stone and Webster utilities, a post which he held until ill health forced him to resign it in 1931.

He returned to Sierra Pacific Power Co. as sales manager and while in that capacity developed the merchandising plan whereby the utility does no direct selling but cooperates with local dealers in placing merchandise.

He later became vice-president of the company and in 1941 was named president to succeed the late George A. Campbell.

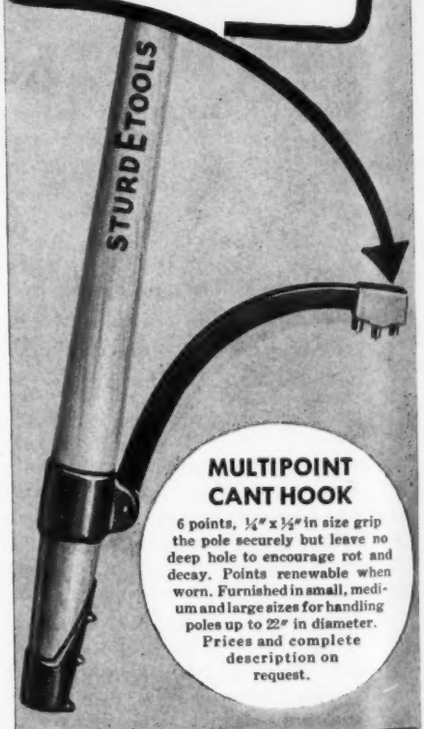
Photograph illustrates efficient sure grip and automatic release of Multipoint Hook.

SAVE THE POLES

• The Sturd-E exclusive Multipoint Cant Hook speeds up pole handling and saves the poles—its six quarter-inch by half-inch points grip much more firmly than a single point—in addition, they do not penetrate the creosote treatment. Result—no deep stab wounds where water collects and rot can start.

Made in three sizes for handling all poles—from the smallest to the big ones 22 inches in diameter. Every utility that has tested the Multipoint Cant Hook has reordered in ever increasing numbers—it saves poles, time, and cost.

STURD E TOOLS a TRUE TEMPER PRODUCT



MULTIPOINT CANT HOOK

6 points, ¼" x ½" in size grip the pole securely but leave no deep hole to encourage rot and decay. Points renewable when worn. Furnished in small, medium and large sizes for handling poles up to 22" in diameter. Prices and complete description on request.

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SHAWMUT SHUR-LAG RENEWABLE FUSES

because at last you'll be rid of needless shutdowns and delays from inefficient fusing. Nearly half a century of superior engineering skill and manufacturing craftsmanship, devoted exclusively to the making of electrical protective devices, stands behind SHUR-LAG fuses. Now as ever, they are the simplest, sturdiest, most serviceable time-lag fuses you can buy, and the easiest and quickest to renew. Don't take chances, ask your dealer today about SHAWMUT SHUR-LAG FUSES or write for our Bulletin 400.

THE CHASE-SHAWMUT COMPANY
NEWBURYPORT, MASSACHUSETTS

FUSE MAKERS SINCE 1893

MANUFACTURING-MARKETS

Conservation Plan Brings Results

That results are being obtained through the conservation program was pointed out by L. J. Martin, assistant chief of the WPB Bureau of Priorities in Charge of Enforcement, at the priorities training school conducted recently under the sponsorship of the National Electrical Manufacturers Association, for electrical manufacturers by the War Production Board—the first to be held for any industry group. "It will take time and money to carry out this program," he asserted, "but we are making real headway because of American industry's willingness to chip in and not hold back until material is requisitioned. We don't want to requisition unless it is absolutely necessary. . . ."

In his expression of the industry's appreciation of the training course, George C. Thomas, Jr., president of NEMA, who presided at the luncheon held at the Hotel Pennsylvania, referred to the efforts of the association to educate its members on priorities procedures and operation. "The battle of production has been pretty well won," he said. "Our capacity to produce has gone far beyond the supply of materials. That is why WPB has such a great problem on its hands and why we in the electrical manufacturing industry are faced with equally great responsibilities. Thus far we have conducted sixteen regional one-day meetings on priorities and a second series of meetings is now under way."

•

Copper and Brass Group Elects New Officers

At the annual meeting of the Copper and Brass Research Association held recently in New York, Robert L. Coe, vice-president of Chase Brass & Copper Co., Inc., Waterbury, Conn., was elected president.

Other officers elected were: Vice-presidents, John A. Coe, American Brass Co.; Wylie Brown, Phelps Dodge Copper Products Corp.; R. E. Day, Bridgeport Brass Co.; C. L. Smith, National Copper & Smelting Co., and William M. Goss, Scoville Manufacturing Co., Treasurer, C. Donald Dallas, Revere Copper & Brass, Inc.; manager, T. E. Veltfort; secretary, Bertram B. Caddle.

•

Foxboro Honors Employees

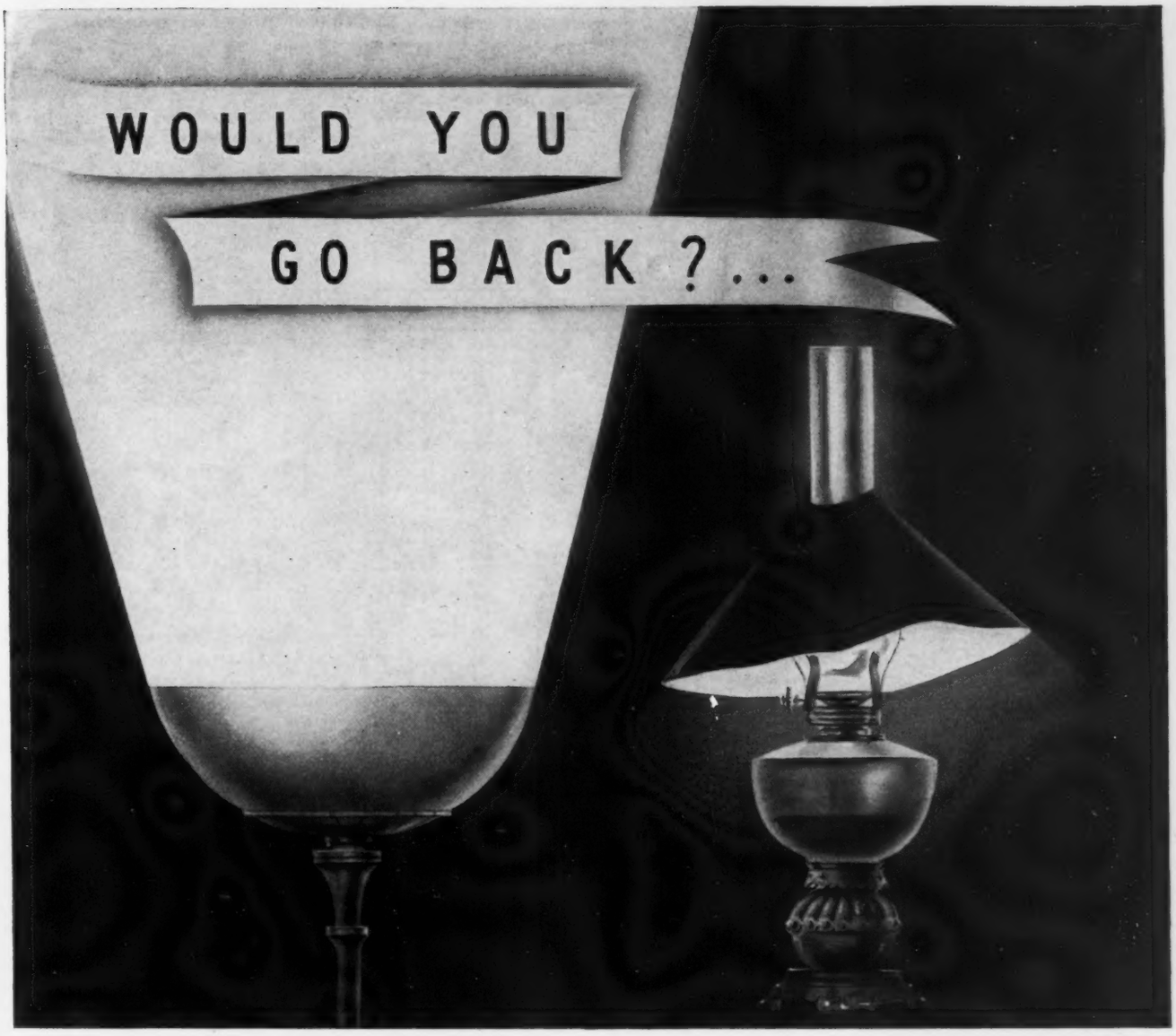
Employees of the Foxboro Co. who have completed 25 years or more in its service were guests of the company at a celebration held at the main office, Foxboro, Mass., last week. A jeweled service pin of gold was presented to each of the 50 men and women thus honored.

Industry Warned to Keep High Level

Charles E. Wilson, president of General Electric Co., warned a meeting of leading business executives last week that the survival of free private enterprise depends on maintaining during the post-war period the high levels of production now being developed to meet the current emergency. Mr. Wilson spoke at the annual conference of the National Federation of Sales Executives at the Hotel Roosevelt, New York.

"Once we let the wheels stop and the machines grow idle and hang out the 'no employment' sign, we will have launched a downward economic and political spiral that will strangle our system of free enterprise and make the dark hours of the last depression look

RECEIVES SERVICE CERTIFICATE—Fred P. Wilson, retiring manager of General Electric's contract service department, receives a certificate in recognition of 51 years of service with the company. The award was made at a dinner in his honor at the Mohawk Golf Club, Schenectady. Vice-President David C. Prince (left) is shown presenting the certificate, while W. W. Trench, secretary of the company (right), holds a scroll signed by all men of the contract service department



A BETTERMENT . . .

Not a Substitute

Kerosene lamps were better than the tallow dip . . . The modern electric light is a BETTERMENT over gas for artificial illumination.

Who would want to go back to kerosene lamps?

No more will designers and engineers, who replace weighty—corrosive—costly—hard-to-get materials with engineered CONTINENTAL-DIAMOND NON-metallics, want to go back to the materials replaced.

C-D NON-metallics are not substitutes.

They should and can achieve BETTERMENT of product, process or performance. C-D NON-metallics are better suited to meet many of the material problems of either a war or peace economy than are many habitually used . . . now hard-to-get . . . materials.

C-D NON-metallics offer unique characteristic combinations. For example, DILECTO, one of five C-D NON-metallics, combines high Dielectric Strength, Corrosion Resistance, Light Weight (Specific Gravity 1.36), Resiliency, Moisture Resistance and Adaptability for High Speed, Accurate Fabrication on standard metal-working machinery. The other four C-D NON-metallics offer equally advantageous characteristic combinations.

Get acquainted with all FIVE C-D NON-metallics by sending for Bulletin GF-12. When you are ready to get down to brass tacks on specific problems . . . write, wire or phone us to send around one of our Research Engineers.

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

M.I.F. Malleable Ribbed Washers

These Malleable Ribbed Washers use the metal to better advantage than comparable steel plate washers or cast iron ogee washers.

When deliveries of cut steel washers are seriously delayed, or when heavier washers are required, M.I.F. Malleable Ribbed Washers as tabulated may provide a welcome alternative. Compared with cast iron ogee washers, Malleable Ribbed Washers give equal steady strength and greater shock strength with approx. one-half the weight, conserving essential war materials and making possible the use of shorter bolts.

The first group consists of curved back washers of rectangular bearing area. The radius of curvature is approx. 4", assuring proper bearing on pole, post, pile, etc., from less than 7" diam. to 12" diam., or more. The grip of the vertical edges on larger diam. pole, etc., minimizes splitting stresses.

Prices listed are net, F.O.B. Branford, for galvanized castings. Lower unit prices apply for larger quantities. Ungalvanized washers are priced approx. $3.00/cwt. less.

One trial order will be accepted for a miscellaneous assortment of any quantities at these 100-lot prices.

Catalog Number	Bearing Area	Bolt Diam.	Dim. "A"	Ship. Wt. Lbs./C.	100-Lot Price
P143	3"x3"	5/8"	5/16"	45.	$7.70/C.
P143A	3"x3"	3/4"	3/8"	65.	9.80/C.
P143B*	3"x3"	5/8"	5/16"	55.	9.70/C.
P144	4"x4"	3/4"	7/16"	85.	13.30/C.
P144A*	4"x4"	3/4"	7/16"	120.	17.50/C.
P145	4"x4"	1"	11/16"	150.	21.00/C.
P146	5"x5"	1-1/4"	13/16"	290.	37.80/C.
P147	6"x6"	1-1/2"	15/16"	490	58.80/C.
P119	6"x6"	1"	5/8"	325	49.00/C.
P120	3"x4"	3/4"	7/16"	100.	15.40/C.
P121	3"x4"	1"	7/16"	100.	15.40/C.
P55	2-5/8"d.	5/8"	3/8"	35.	5.60/C.
P84	3"d.	3/4"	7/16"	45.	7.00/C.
P85	4"d.	1"	1/2"	80.	13.30/C.
P85A	6"d.	3/4"	7/8"	215.	30.80/C.
P85A-1	6"d.	1"	7/8"	210.	30.80/C.
P85B	5"d.	1-1/4"	13/16"	185	25.20/C.
P85C	5"d.	1-1/2"	7/8"	265.	36.40/C.
P56½	2¼" sq.	1/2"	9/32"	24.	2.50/C.
P56⅝	2¼" sq.	5/8"	9/32"	23.	2.50/C.
P56¾	2¼" sq.	3/4"	9/32"	22.	2.50/C.
P57	3"x3"	5/8"	5/16"	50.	7.70/C.
P58	4"x4"	3/4"	7/16"	100.	13.30/C.
P123	4"x6"	1"	1/2"	175.	24.50/C.
P124	4"x4"	1"	1/2"	115.	16.10/C.

Dimension "A" is the thickness of the boss around the bolt hole.

NOTE:—P143B and P144A have nut retainers for use with log anchors, etc.

MALLEABLE IRON FITTINGS COMPANY

Pole Hardware Dept. [Factory and New England Sales Offices] **Branford, Connecticut**

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How to design, install, and service fluorescent-lighting systems

Just Out!

FLUORESCENT LIGHTING MANUAL

By CHARLES L. AMICK
Nela Park Engineering Dept., General Electric Company

312 pages, 6x9, 217 illustrations, many tables. $3.00

CHAPTERS

1. The Fluorescent Lamp
2. Auxiliary Equipment
3. Operating Characteristics
4. Installation Hints
5. Service Suggestions
6. Luminaire Selection
7. Fluorescent-lighting Design
8. Color Quality
9. Fluorescent Applications
10. Lighting Economics

Make sure you get the extra profits promised by the growing popularity of fluorescent lighting. Here is a practical manual covering the subject in all its aspects, presented so that anyone can understand it, with or without much electrical training. Gives the most authoritative information available on construction and performance of all types of fluorescent lamps, principles and methods of calculating illuminating requirements and designing luminaires and installations, pointers and methods of installing and maintaining fluorescent lamps and of locating and remedying their troubles. Includes working data, comparison of cost factors of fluorescent and incandescent lighting, etc.—everything to aid in the designing, selling, installing, and servicing of efficient and satisfactory fluorescent-lighting systems.

10 DAYS' FREE EXAMINATION

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Send me Amick—Fluorescent Lighting Manual for 10 days' examination on approval. In 10 days I will send $3.00 plus few cents postage or return book postpaid. (We pay postage if you remit with order.)

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like high noon by comparison," he declared.

"A nation which has exhibited the production genius and the amazing capacity for progress which our nation has, cannot think for a minute of scrapping the machine and dropping back to where we were," Mr. Wilson stated.

•

Manufacturers Issue Earnings Reports

Westinghouse Electric & Manufacturing Co. reports for the first quarter of 1942 sales billed amounting to $112,159,411, compared with $81,141,645 for the similar period of 1941. Orders booked totaled $282,387,969, compared with $144,795,948 in 1941. Net income after provision for taxes amounted to $4,124,654, against $5,627,264 for the first quarter of 1941, a decrease of 27 percent.

Among the other companies issuing earnings reports are the following:

WESTON ELECTRICAL INSTRUMENT—Including wholly owned subsidiary, March quarter: net profit, $118,140, after a provision of $1,213,000 for Federal income and excess profits taxes, equal to 73 cents a share on 160,583 shares of common stock, compared with $256,388, or $1.59 a share, in the first quarter of last year, after deducting $415,400 for taxes. Federal income and excess profits taxes in the first quarter of this year are based on rates in effect under the Revenue Act of 1941, plus $285,000 for the increase in taxes anticipated under legislation now pending.

MCGRAW ELECTRIC—Twelve months to March 31: Net profit, $1,437,333, after provision of $1,923,000 for state and federal income and excess profits taxes, equivalent to $3.04 a share on 472,600 common shares, compared with a revised net profit of $1,536,724, or $3.25 a share, in the twelve months to March 31, 1941.

•

Start Work on Three New Units for Grand Coulee

Three more 108,000-kw. waterwheel generators for Grand Coulee Dam are now being built, Westinghouse Electric & Manufacturing Co. has announced. This brings to nine the number Westinghouse has contracted to build for Grand Coulee. Three of the 108,000-kw. machines already have been completed and installed and three have been under construction since last August. Ultimately, Grand Coulee will have 18 of these 108,000-kw. units.

Last week the 151-mile reservoir dam filled and, as 15,000 persons watched, the Columbia River poured through the spillways, symbolizing completion of the huge main unit of the project.

Famous Two-Somes

CIRCUS AND PINK LEMONADE

Hey! Hey! Get your pink lemonade—it shines your teeth and curls your hair—here you are. Pink lemonade and circus day—what a combination. No beverage ever had a greater "kick" for young Americans—no memory remains so vivid. Pink lemonade and the circus—of course, you remember. Time does not sever this association.

There is another combination of words—far removed from sawdust and tinsel—but important, to always keep together. The words are *Macallen* and *Mica*. When you write specifications—write Macallen Mica.

PRODUCTS

Compressed Sheets — Mica Paper, Cloth, Tape. Heater Plate, Compressed Sheet Tubing — Commutator Insulation — Compressed Sheet Washers — Insulating Joints and Canopy Insulators — Railway Specialties—Domestic and Imported Raw Mica. Always specify *Macallen Mica*.

THE MACALLEN COMPANY

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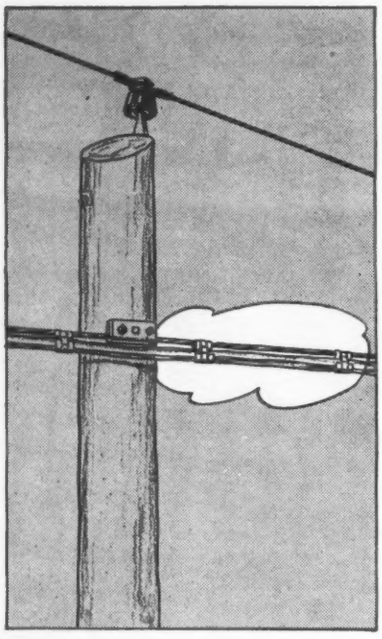
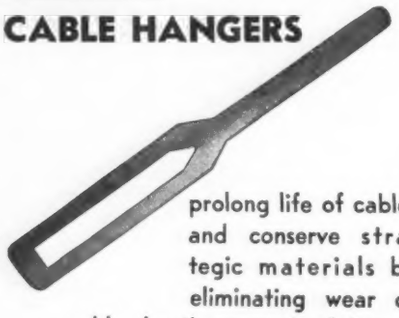
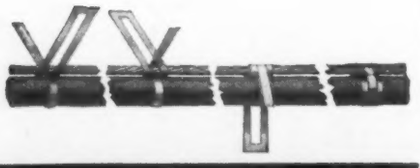
Reduce Outages
Avoid Cable Wear
Reduce Maintenance



RELIABLE CABLE HANGERS



prolong life of cables and conserve strategic materials by eliminating wear on cable sheaths or on insulation of hand made cables. Reliable cable hangers hold cable and messenger together tightly with wide bearing surfaces which eliminate snaking and chafing. They are easily applied and make installations that are permanent and very neat



Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE • CHICAGO ILLINOIS

Field Reports on Business

The war program is accelerating factory expansion and new plant construction throughout the country. Demand for electrical equipment continues unabated and deliveries are scheduled far ahead. Utilities' stocks of merchandise have shrunk and these companies are stressing conservation of appliances already in use.

NEW YORK

Retail sales in the Eastern area showed declines last week for the second consecutive week over figures for the corresponding period last year; declines of 10 to 15 percent were registered. Federal Reserve Board figures on department store sales showed an 11 percent drop for the nation; an 8 percent drop for the New York state area and 5 percent for New York City. Trade volume for the four-week period ended June 6, however, showed about the same level as 1941's period. Consumer purchasing power is at a new high, it is pointed out; store stocks are larger and there is every evidence that volume may pick up again at any time.

A Conference Board report on first-quarter corporate profits shows that they registered a 29 percent gain before taxes, but a 25 percent drop in net after taxes. The survey included 41 public utilities which showed an 11 percent drop in their 1941-1942 earnings and a 14 percent drop in their 1940-1942 ratios.

Engineering construction volume for the week totaled $274,971,000, the second highest volume reported for the current year and the third highest on record, according to *Engineering News-Record*. The latest figure is 68 percent up over the previous week and 108 percent over the corresponding week in 1941. Public construction continued to be responsible for the most of the gains, but it is interesting to note that private construction gained 190 percent over the previous week, while remaining 52 percent below the corresponding week last year.

NEW ENGLAND

Six electric utility plants in this area are pushing construction of steam generating capacity aggregating 193,000 kw. for completion in 1942. Closer co-ordination of interconnected systems in the northeast is progressing to more efficiently meet war loads. This work includes 110-kv. line construction to reinforce existing regional facilities and tie into certain important industrial districts on a larger scale. An important electrical tie line will soon complete a voltage rise from 66 to 110 kv., involving substantial use of new circuit breakers, transformers and auxiliary equipment.

Housing activities associated with war and ship construction plants are active. These are absorbing appliances and wiring material, but the total volume of this class of business is insufficient to fill the gap brought about by the virtual cessation of ordinary domestic load building and merchandising. Utility stocks of merchandise have shrunk greatly, some utility outlets now holding about 50 percent of the appliance inventory which they possessed a few months ago. Much of this merchandise is frozen and so cannot be moved without suitable priorities, but it is hinted that some of the higher priced ranges will be released before long by governmental sanction.

Industrial betterment work looking toward increased production of war material and more efficient manufacturing is absorbing power sales departments of utilities and manufacturers' representatives. The demand for improved control equipment, industrial lighting units, motors and electric heating apparatus continues heavy.

PACIFIC COAST

An increasing number of communities, particularly in California, with its many new war plants, are requesting appropriations for post-war projects to lessen economic shock, such as Sacramento for $3,000,000 and San Francisco for $87,458,785, including $48,000,000 for its electric utility enlargements and extensions in the Sierra region. Low figures for Boise power project were $299,800 for two 18,500-hp. turbines, $39,590 for two Woodward governors and $253,260 for two Westinghouse 15,000-kva. generators. Davis Dam in Arizona will shortly open bids for five 45,000-kva. generators.

Washington has approved a $3,723,000 appropriation for transmission extensions of California Central Valley project, plus $200,000 for Antioch steam plant preliminaries. A $1,650,000 extension of East Bay electric suburban lines to Richmond is a possibility. General Electric has been awarded $792,000 of circuit breakers and disconnecting switches for Keswick plant in Shasta region. Electric crane business is especially good, with awards to Shepard of $167,281 and Harnischfeger of $136,050 in Puget Sound area; to Harnischfeger of $208,000 for an Idaho heavy gun plant, and to Star of Tacoma for $491,000 for naval bases at Hawaii and near San Francisco.

CHICAGO

Armament activity is accelerating as a result of factory conversions and new plant construction throughout this area. During the past month $5,085,000 was spent for additional plant facilities in the metropolitan area of Chicago. For the first five months of this year $286,438,000 has been invested in new factory construction as compared with $107,182,000 in the same period of 1941.

Although industrial employment and payrolls have shown a marked increase over last year, the additional workers required in the new plants now under construction will bring a major expansion in employment within the next year.

Retail trade declined sharply last week with department store sales falling 23 percent below the previous week and 17 percent under a year ago. April sales of industrial electric trucks totaled 571, compared with 376 for the preceding month and 430 for the comparable month last year. The demand for all types of electrical equipment for industrial use continues unabated and deliveries are scheduled far ahead.

Further restrictions on non-esstntial building and curtailments of critical materials are further handicapping many small electrical contractors. With most of the ordering of materials now being done on a priority basis, many contractors not doing war work will be forced to close when present inventories are exhausted.

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following assignments to their sales staffs:

Standard Transformer Co., Warren, Ohio, announces the appointment of G. W. Fischer as New York district manager, with headquarters at 101 Park Avenue.

Pittsburgh Reflector Co. has appointed R. O. Williams sales manager, Midwest Division. For the past nine years Mr. Williams has been manager of the Chicago branch office. He will continue to head the Chicago office, from which he will direct the sales activities in the Middle West district.

•

REA Announces New Allotments

The Rural Electrification Administration recently announced allotments totaling $2,290,000 to nine systems in seven states, bringing the total allotments to $448,911,244, of which $80,213,200 represents operations during the current fiscal year. Most of these allotments include funds for the acquisition of existing facilities.

Details are as follows:

KENTUCKY—Pennyrile Rural Electric Cooperative Corp., Hopkinsville, J. O. Porter, Supt., $420,000 for 290 miles of line, 2,201 members. This includes acquisition of 120 miles of rural lines of Kentucky-Tennessee Light and Power Co. Warren Rural Electric Cooperative Corp., Bowling Green, Lester Wright, Supt., $218,000 for 240 miles of line, 1,107 members. This includes acquisition of 105 miles of rural lines from Kentucky-Tennessee Light and Power Co. West Kentucky Rural Electric Cooperative Corp., Mayfield, $253,000 for 203 miles of line, 1,483 members. This includes acquisition of 88 miles of rural lines from Kentucky-Tennessee Light and Power Co.

LOUISIANA—Claiborne Electric Cooperative, Inc., Homer, T. E. Stevenson, mgr., $265,000 for 185 miles of line, 1,105 members. This includes funds for purchase and rehabilitation of the systems of Farmerville and Marion.

MISSOURI—New-Mac Electric Cooperative, Inc., Neosho, C. L. Langley, supt., $415,000 for 308 miles of line, 1,659 members. This includes funds for acquisition of 94 miles of rural lines from Missouri Southern Public Service Co.

OKLAHOMA—Northwestern Electric Cooperative, Inc., Woodward, $440,000 for 244 miles of line, 1,324 members. This includes funds for acquisition, rehabilitation and integration of 44 miles of line from Panhandle Public Service Co.

OREGON—Malheur Cooperative Electric Assn., Vale, $4,000 to provide installation loans for cooperative members.

TENNNESSEE—Tri-County Electric Membership Corp., Lafayette, $175,000 for 105 miles of line, 845 members. This includes funds for acquisition of 20 miles of rural lines from Kentucky-Tennessee Light & Power Co.

WYOMING—Shoshone River Power, Inc., Cody, J. C. Nichols, pres., $100,000 for construction in the future of 125 miles of line, 174 members.

BETTER PERFORMANCE . . . AT LOWER COST

SAVE ON INITIAL COST AND INSTALLATION

"PYREX" 10-in. Insulators are now 8 to 13% lower in price than competitive 10-in. units.

"PYREX" 9-in. Insulators are now 17 to 21% lower in price than competitive 10-in. units.

Stable one-price-to-all basis. Fewer than ½ as many price changes for "PYREX" Insulators as for competitive units in past 5 years.

Installation of "PYREX" strings with patented hinged crate is speedier. High M & E strength of "PYREX" Insulators usually makes double stringing unnecessary.

SAVE ON PERFORMANCE AND MAINTENANCE

"PYREX" 18,000-lb. suspension units duplicate the performance of 25,000-lb. competitive units. And in M & E tests at 25,000 lbs. and higher, 95% of breaks are in hardware, not in glass.

No "PYREX" Insulator has ever been reported to us by users as having failed from electrical causes alone.

A recent independent analysis indicates "PYREX" Insulators will eliminate ⅓ of all failures (electrical and mechanical).

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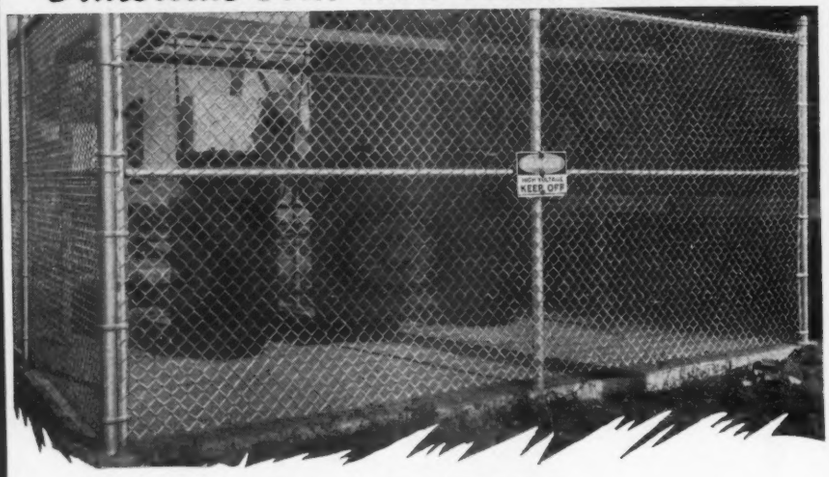

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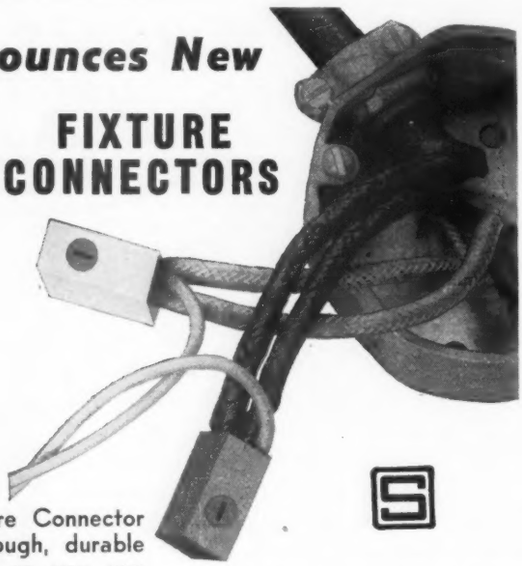

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Sales Opportunities

Wartime censorship places necessary restrictions on the publication of details of various projects, including exact location and other information.

GEORGIA—Georgia Power Co., Atlanta, plans new 110,000-volt transmission line of about 100 miles with a new 7,500-kv. terminal substation and distribution lines. Work is scheduled for completion in November. Company also plans another high-tension line of like capacity out from Atlanta area to serve a large industrial plant soon to be built; a power substation will be located at plant site for distribution service. Proposed to complete latter project early in 1943.

NEW YORK—Wheatfield Chemical Division, Durez Plastics & Chemicals, Inc., Walck Road, North Tonawanda, plans complete electric power equipment and facilities in new multi-unit plant in Western part of State. Cost estimated about $3,000,000. Rust Engineering Co., Clark Building, Pittsburgh, Pa., will design new plant and supervise erection.

LOUISIANA—War Department, Washington, D. C., plans electric power equipment and facilities in new depot warehouse in Louisiana, comprising several large units, to cost over $3,000,000. Project will be carried out under direction of United States District Engineer Office, New Orleans.

CALIFORNIA—Aluminum Co. of America, Inc., Gulf Building, Pittsburgh, Pa., has concluded agreement with government for construction and operation of new aluminum ore-processing plant in Stanislaus County with estimated connected load approximating 100,000-kw. Power supply will be secured from an existing hydro-electric power station a number of miles distant, with transmission line to be constructed to plant site. Entire project will cost about $12,000,000, with financing to be provided by Defense Plant Corporation, Washington, D. C. Work is scheduled to begin soon, with initial plant units to be ready for service early in 1943.

INDIANA—Public Service Co. of Indiana, Indianapolis, will begin superstructure soon for proposed addition to Dresser steam-electric generating station, and has placed award for about 760 tons of structural steel for this purpose. Capacity of plant will be increased. Switchyard will be enlarged, with extensions in transmission and distributing lines in station area. Sargent & Lundy, Inc., 140 South Dearborn Street, Chicago, Ill., is consulting engineer.

TEXAS—Humble Oil & Refining Co., Humble Building, Houston, plans complete electric power equipment and facilities in two new plants in Texas for production of synthetic rubber for government. Entire project will cost about $40,000,000, with financing to be furnished by Defense Plant Corporation, Washington, D. C., in part, and remainder by company.

ILLINOIS—Republic Steel Corp., Republic Building, Cleveland, Ohio, has taken out permit for new two-story steam-electric power plant for Chicago district. Cost reported over $1,000,000, with turbine-generator, boilers and auxiliaries. Superstructure is scheduled to begin at once. United Engineers & Constructors, Inc., 1401 Arch Street, Philadelphia, Pa., is consulting engineer in charge of construction.

KANSAS—War Department, Twentieth Street and Constitution Avenue, N.W., Washington, D. C., has authorized construction of new air force training school. Complete electrical equipment and facilities will be installed for residential, industrial and airport service. Cost estimated about $3,000,000. Project will be carried out under direction of United States District Engineer Office, Tulsa, Okla., which will place all contracts for work.

OKLAHOMA—Oklahoma Gas & Electric Co., Oklahoma City, has preliminary plans for enlarging A. S. Huey station, with new 20,000-kw. turbine-generator unit and high-pressure boiler. Completion scheduled in summer of 1943. Switchyard will be enlarged and extensions made in transmission lines. This is part of an expansion and improvement program for which company has authorized total fund of about $2,450,000.

TEXAS—Phelps-Dodge Corp., 40 Wall Street, New York, N. Y., plans electric power equipment and facilities in connection with expansion in electrolytic copper refining plant in Texas. Cost about $2,650,000. Work is scheduled to be carried out at once. Company also plans extensions in copper mining properties in Arizona, with installation of electric power facilities.

NEBRASKA—Howard County Rural Public Power District, St. Paul, plans extensions in primary and secondary lines in parts of Howard and Greeley counties, including service facilities.

ARKANSAS—Arkansas Power & Light Co., Pine Bluff, has authorized construction of new 13,000-volt transmission line in Guion district, to be used for power supply for an industrial plant in that area, with power substation to be located at plant site.

OHIO—Electro Metallurgical Co., 137 Forty-seventh Street, Niagara Falls, N. Y., will install electric power equipment and facilities in new plant in Ashtabula County, comprising several large units for production of calcium carbide, ferro-silicon and kindred specialties. Cost reported over $4,000,000. Financing through Defense Plant Corporation, Washington, D. C. Work is scheduled to begin soon.

WISCONSIN—Oconto Electric Cooperative, Inc., Oconto Falls, will defer construction of proposed new hydroelectric generating station until after the war. Plans have been drawn by Orbison & Orbison, 206 West College Avenue, Appleton, Wis., consulting engineers.

OHIO—Cleveland Electric Illuminating Co., Cleveland, plans extensions in 132,000-volt transmission line in section of city.

ILLINOIS—Howard Aircraft Co., 5301 West Sixty-fifth Street, Chicago, B. D. De Weese, president, plans complete electric power equipment and facilities in new plant in Illinois, with main unit about 199 x 440 ft. Cost over $500,000. Engineering Systems, Inc., 221 North LaSalle Street, Chicago, is consulting engineer.

WASHINGTON — Grays Harbor County Public Utility District No. 1, Aberdeen, plans new metering station near Cosmopolis. Bids are scheduled to be asked soon.

WISCONSIN — National Guard Bureau, Camp Douglas, Col. Henry C. Hengels, purchasing and contracting officer, plans early call for bids for new power substation.

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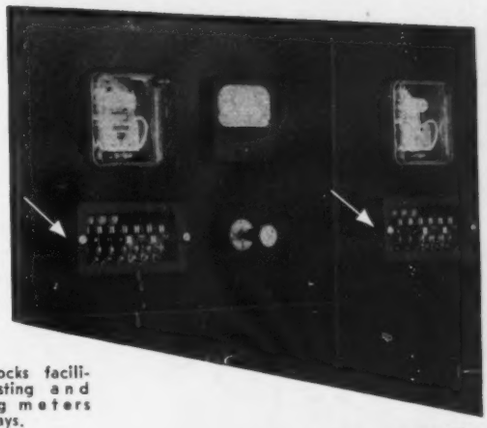

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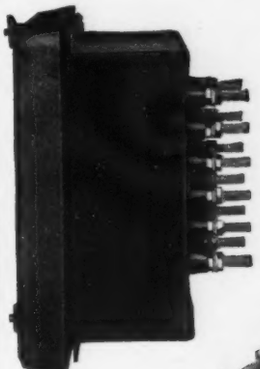
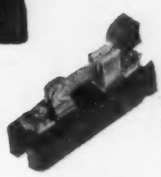
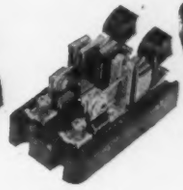


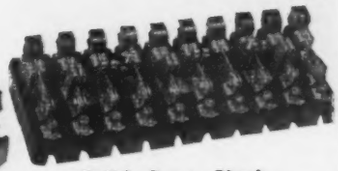
Top view of flush mounting



Potential



Current



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LETTERS TO THE EDITOR

Power Supply for Resistance Welders

To the Editor of ELECTRICAL WORLD:

On page 92 of the February 7 issue of ELECTRICAL WORLD C. E. Heitman, Jr., gave an approximate process for finding the ratio of primary to secondary turns, A, in a welding transformer with tapped primary so that it will give maximum secondary current I_2 under the assumptions:

1. Supply voltage is constant.
2. Impedance of primary winding and supply leads is substantially constant and $= Z_1$.
3. Impedance of secondary winding in terms of primary is constant for all positions of primary tap $= Z_2$.
4. Exciting current is small enough to be neglected.
5. Impedance of secondary leads, electrodes and weld in terms of primary $= A^2Z_3$.
6. All three impedances Z_1, Z_2 and Z_3 have nearly the same phase angles.

In view of the general nature of transformer action, the conclusion reached would seem to require further justification. For example, the local impedance of primary winding and leads in a core type transformer instead of being constant is more nearly equal to

$$Z_1 = (r_e + Ar'_1) + j(X_e + AX'_1), \quad (1)$$

Where r_e and x_e = resistance and reactance of primary leads and r'_1 and x'_1 = constants.

The impedance of the secondary circuit in terms of primary is equal to $A^2(Z'_2 + Z_3)$ rather than $Z_2 + A^2Z_3$ as given in the article. Here Z'_2 = local impedance of secondary winding in terms of secondary. However, if we assume that Z_1 is constant, a corrected expression for A would be

$$A = \sqrt{\frac{Z_1}{Z'_2 + Z_3}} \quad (2)$$

as against Mr. Heitman's

$$A = \sqrt{\frac{Z_1 + Z_2}{Z_3}} \quad (3)$$

If the impedance of the primary leads is neglected, we may write $Z_1 = AZ'_1$

then $I_2 = \frac{AE_1}{AZ'_1 + A^2Z} = \frac{E_1}{Z'_1 + AZ}$ (4)

with $Z = Z'_2 + Z_3$. This does not give a maximum or minimum.

Strictly speaking, Z_1, Z'_2 and Z_3 are complex quantities which should be eliminated before performing the differentiation. This is a point that could well be emphasized more in our textbooks. When set up in this way the expression for secondary current is,

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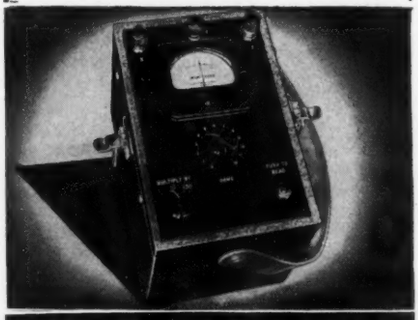

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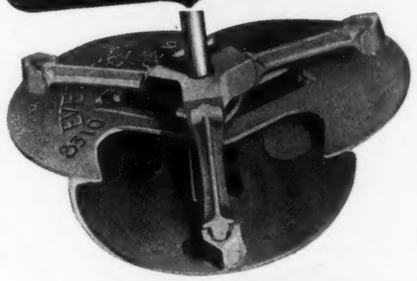

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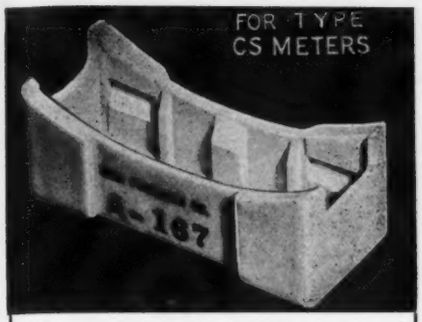

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$$I_2 = \frac{AE_1}{\sqrt{(Ar'_1 + A^2r)^2 + (Ax'_1 + A^2x)^2}} \quad (5)$$

taking $\frac{dI_2}{dA} = 0$ then gives

$$A = -\frac{r'_1 r + x'_1 x}{r^2 + x^2} \quad (6)$$

Here, of course, the assumptions cease to hold long before the ratio becomes as low as this, so that this value of A cannot be realized in practice.

A numerical example will illustrate the questions raised with greater clarity.

Assuming a transformer with a nominal ratio of 220/55 volts and 25/100 amp. Let $I_2Z'_2 = 10$ percent $= 0.1 \times 55 = 5.5$ volts, with $Z'_2 = \frac{5.5}{100} = 0.055$ ohms; $I_2Z_2 = 55 - 5.5 = 49.5$ volts, with $Z_2 = \frac{49.5}{100} = 0.495$ ohms; $I_1Z_1 = 10$ percent $= 0.1 \times 220 = 22$ volts, with $Z_1 = \frac{22}{25} = 0.88$ ohms. All phase angles are considered equal. By Heitman's formula (3),

$$A = \sqrt{\frac{0.88 + 4^2 \times 0.055}{0.495}} = 1.88 \quad (7)$$

By Eq. (2)

$$A = \sqrt{\frac{0.88}{0.055 + 0.495}} = 1.26 \quad (8)$$

Both values, from Eq. (7) and (8) are too small for practice. Assuming that the phase angles of all impedances are equal to 36° 50′, the impedances are

$$Z_1 = 0.88 \times (0.8 + j0.6) = 0.704 + j0.528$$

$$Z'_2 = 0.055 \times (0.8 + j0.6) = 0.044 + j0.033$$

$$Z_2 = 0.495 \times (0.8 + j0.6) = 0.396 + j0.297$$

$$r = 0.044 + 0.396 = 0.440$$

$$x = 0.033 + 0.297 = 0.330$$

$$r'_1 = r_1/A = 0.704/4 = 0.176$$

By Eq. (6)

$$x'_1 = x_1/A = 0.528/4 = 0.132$$

$$A = -\frac{0.176 \times 0.440 + 0.132 \times 0.330}{0.440^2 + 0.330^2} = -0.400. \quad (9)$$

Comparison of the results in Eq. (7), (8) and (9) with the nominal ratio 4 shows enough departure to warrant further analysis before the proposition may be considered as established, even though a different choice of constants might lead to a better agreement among the several formulas.

A. F. PUCHSTEIN,
Celanese Corp. of America,
Narrows, Va.

•

Flo-coating Not New

To the Editor of ELECTRICAL WORLD:

On page 76, ELECTRICAL WORLD, issue of May 16, 1942, in a short article entitled: "Flo-coating saves Refinishing Time," by G. C. Pugh, the state-

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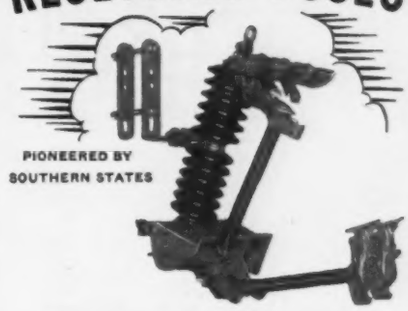

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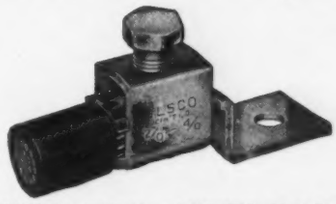

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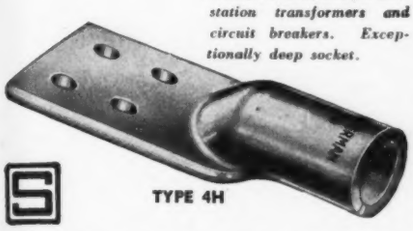

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Acme Air Cooled Transformers now available for prompt shipment in following ratings.
30 to 50 KVA, 60 cycle, 3 phase 240/480; 600; 2400 volt primary.
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ment is made: "It is only within the last few years that Flo-coating has been used successfully in the field with transformers in service." This statement is erroneous, as this method was developed in the field in 1928 by R. A. McClenahen and his associates in Public Service Production Company of New Jersey and was later introduced in the various transformer manufacturing plants in order to comply with the painting requirements of transformer specifications used by the Public Service organization.

In an article that appeared in ELECTRICAL WORLD, September 15, 1934, R. A. McClenahen fully described the process of flow painting transformers, including the reasons for its development, which took place entirely in the field beginning in 1928. Mr. McClenahen and associates worked out the type of nozzles to use, the proper degree of thinning, specific gravity of paints, etc., as related to humidity and temperature of the atmosphere. Representatives of several paint manufacturers assisted in working out these details and spread the idea to other operating companies. The process was described in a number of engineering committee meetings during the six years prior to the publication of Mr. McClenahen's article.

P. S. READER
Newark, N. J.

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Format Better Adapted to Clipping

To the Editor of ELECTRICAL WORLD:

I feel obligated to comment on the changes which have become evident in the style of assembly of material in ELECTRICAL WORLD. For some years I have offered complaints and suggestions to members and representatives of ELECTRICAL WORLD staff with regard to the manner in which technical articles have been broken up into small parts and placed in inconvenient positions throughout the magazine. Whether or not my complaints have had any effect, there seems to be a definite change in policy in this respect. I refer, for example, to such cases as where a technical article may start at the beginning of the magazine and where one page only of this article may have appeared in this position, the remainder of the article appearing in separate columns, and even parts of columns, throughout the advertising at the back of the magazine.

Several technical articles would be intermixed in such a manner that clipping of these articles would be next to impossible, and if it was possible to clip the article, although actually consisting of only a couple of pages, it would require the clipping of several sheets

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This Greenlee Folder S-114 describes the handy Greenlee Knockout Tools for enlarging knockouts and holes in metal without long tedious drilling, reaming, or filing.

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The Greenlee Cable Puller Folder S-115 shows how this handy tool, which clamps right on to the conduit through which the cable is pulled, can make the tough job of cable pulling easy for the electrician.

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of paper. This annoying situation almost culminated in the discontinuance of my subscription, even though the articles were of value, and in many cases the personal annoyance of following an article through a magazine almost offset the value.

I note now that an effort is made to complete articles on one sheet of paper, such as, for example the article on a throw-over scheme on page 51 of the May 2 issue. A happy solution also is to complete a technical article on a page where a non-technical article starts, such as page 53 of the same issue, where the article on resistance welders is completed on page 55, on which an article on home service starts. The point is that being an engineer, the first article is of interest to me and the second is not. On the other hand, a person interested in an article starting on page 55 would not be interested in the welder article. The manner in which the page is filled on page 50, allowing clipping of an article on salvaging of materials, is nicely handled. In general, from the standpoint of the reader, I would summarize by saying that where articles are worth clipping they should be so located in a magazine that the fewest number of sheets possible are involved, and there is no overlap impossible of separation.

Although I may have had nothing to do with the changes of this editorial policy, the results are, nevertheless, appreciated.

P. B. SPEER,
Northern States Power Co.
Minneapolis, Minn.

[We discontinued the practice of running articles over into the back of the magazine the first of this year. This was done in response to requests of readers, like Mr. Speer, who wanted to clip articles for filing.—EDITORS.]

•

Hartford Mercury Unit's 8-Year Service Record

Hartford Electric Light's mercury boiler and turbine-generator unit at the South Meadow station have operated eight years on an availability rate of 95 percent, produced approximately 1.4 billions of kilowatt-hours in electrical energy and equivalent steam and at an average rate of 10,400 B.t.u. per kilowatt-hour. The unit has been on the line over 90 percent of the time during this period.

Operations in 1941 totaled 44,734,000 kw.-hr. gross generated electrical output and 74,310,000 kw.-hr. equivalent electrical energy in the form of steam, the heat rate being 10,494 B.t.u. per kilowatt-hour. During the past year the unit was in service 8,260.75 hours.

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(Classified Advertising)

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(See also "Selling Opportunity" Offered)

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EXECUTIVE AND TECHNICAL MEN, Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 27 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

ELECTRICAL ENGINEER: beyond military age. Broad experience engineering inspection. No objection traveling. Temporary employment acceptable. Earl, 7001 Ridge Boulevard, Brooklyn.

ELECTRICAL ENGINEER — 18 years public utility engineering experience. At present Assistant-Chief Engineer of an eastern Utility. Licensed as a Professional Engineer in the State of New Jersey and Connecticut. Available only for a responsible engineering or executive position. PW-51, Electrical World, 330 W. 42nd St., New York, N. Y.

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MAN with twenty seven years practical experience construction and maintenance transmission, distribution, substation and industrial equipment. Good education, Married, age 48, pleasing personality, well balanced, adaptable, not afraid of work or responsibility. Best of references. PW-54, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

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